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NATIONAL GEOGRAPHIC

NGM.COM APRIL 2012

FREE POSTER
Titanic's Final Moments

BRAZIL'S SECRET SLAVE SOCIETIES

A DEATH-DEFYING K2 CLIMB



TITANIC

WHAT REALLY HAPPENED

EXCLUSIVE NEW PHOTOS OF THE WRECK





Huon Tree Kangaroo
(Dendrolagus matschiei)
Size: Head and body length, about 50 - 75 cm (20 - 30 inches); tail, about 40 - 70 cm (16 - 28 inches)
Weight: About 7.5 - 10 kg (16.5 - 22 lbs)
Habitat: Montane forests, including cloud forests, in high-elevation areas of the Huon Peninsula of Papua New Guinea
Surviving number: Estimated at fewer than 2,500 mature individuals

Photographed by Masahiro Iijima

WILDLIFE AS CANON SEES IT

Why stop at hopping? With the help of its long curved claws and a tail ideal for balancing, the Huon tree kangaroo is an exceptional climber. Most active at dawn and dusk, it moves with ease through the forest foraging for leaves and ferns. Although males may mate with multiple females, they do not establish harems and the females remain independent, caring for their offspring themselves. As with their land-based cousins, the tree kangaroo's young crawl into their mother's pouch. But even their mothers can't climb high enough to be truly safe from the twin threats facing the species: habitat loss and hunting.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit **canon.com/environment** to learn more.

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VOL. 221 • NO. 4

NATIONAL GEOGRAPHIC

In the ritual dance, "runaway slaves" suck on baby pacifiers.
page 132



PHYLLIS GALEMBO

An elephant and a bat pose at the Dodo Masquerade in Burkina Faso, an event where children don masks, sing, and dance under a full moon.

April 2012

36 Climb of Her Life
Her husband turned back. Gerlinde Kaltenbrunner plunged ahead in a risky effort to conquer K2.
By Chip Brown Photographs by Tommy Heinrich

66 Masks That Make Magic
In Africa and its diaspora a mask can turn you into a god—or send a message to the pooh-bahs.
By Cathy Newman Photographs by Phyllis Galembo

78 The Titanic, Illuminated
One hundred years after the ship sent its SOS: "Now we know where everything is."
By Hampton Sides
Poster: How It Sank and Where It Rests

100 Walking With Ghosts
With the aid of robotic avatars, the filmmaker has spent nearly 500 hours exploring the *Titanic*.
By James Cameron

110 Flocking Flamingos
They really do stick together—and that may increase their odds of survival in a perilous world.
By Nancy Shute Photographs by Klaus Nigge

122 Where Slaves Ruled
In Brazil they escaped plantations, created secret societies, and today fight for legal rights.
By Charles C. Mann and Susanna Hecht
Photographs by Tyrone Turner

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY

April 2012

DEPARTMENTS

4 **Editor's Note**
6 **Letters**
8 **National Geographic on TV**
10 **Explorers Journal**

12 **VISIONS** ▸



18 **Your Shot**

21 **NOW**

The Better to Hear With ▸
Copper loops help hearing aid users screen out the background noise.



It's a Grand New Flag ▸
Libya has revived its pre-Qaddafi banner, putting a spotlight on flag design.



Bubbling Up
A sea snail has an unusual way of sailing to the top of the water.

Breaking the Ice
Long-separated bowhead whales get together as the Arctic melts.

31 **NEXT**

Gemstone DNA
New science can help determine if a gem was mined in a war zone.

Shade Shifters
In 700 milliseconds a squid can change skin color and pattern.

Multigun Salute
The Prez gets 21. Who gets 17? 11?

80 Billion Photos a Year ▸
Camera phones help drive an increase in consumer photography.



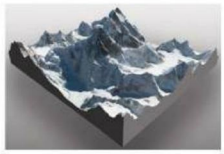
140 **NG Connect**
142 **The Moment**
Flashback

E-GEOGRAPHIC

Here are the coolest extras in our electronic editions.

Tapping Into the Titanic
- Spin our exclusive model of the wreck.
- Watch how the ship broke up after it hit the iceberg.
- Tap on a map of the debris field for more info.

iPad Exclusive



Mountain Woman
- See Gerlinde Kaltenbrunner at the summit of K2.
- Explore a 3-D animation of the "Savage Mountain."

iPad + ngm.com

GERMAN AEROSPACE CENTER - DLR (IMAGE); DIGITAL GLOBE, EUROPEAN SPACE IMAGING (DATA)

On the Cover
To create this image of the splitting of the *Titanic*'s bow and stern, our artist drew upon a roundtable discussion among experts.
Art by Nick Kaloterakis

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Highs and Lows

They say the third time is the charm, but K2, after Mount Everest the second highest mountain, is seldom charming. It's known as the Savage Mountain. Photographer Tommy Heinrich experienced its savagery on his first two climbs. During his first attempt, in 1999, a teammate was killed on the way to Camp I. On his second try, in 2010, another teammate died. After that disaster Tommy was invited by two of his 2010 fellow climbers, Gerlinde Kaltenbrunner and Ralf Dujmovits, to join them on their return to K2. He was honored but anxious. "I left Argentina, my home, feeling there was a very high chance that one of us wouldn't make it back, even myself." He had good reason to worry. During the ascent two avalanches buried the trail in front of him. A third, more dangerous one knocked him upside down, filling his nose and mouth with snow. "Only the fixed rope, taut as a cello string, kept him from being flushed off the mountain," writes Chip Brown in this issue. "He was able to dig himself out, but the slide had refilled the broken trail, and eventually he too turned back."

Tommy was conflicted about turning back.

Tommy was conflicted about turning back. He'd come so far and knew he'd probably never get another chance. "I called Liam, my seven-year-old son," he says. "I knew talking to him would help me make a decision I did not want to make… Go down." Gerlinde and three others reached the summit. She became the first woman to climb every 8,000-meter peak in the world without porters or supplemental oxygen. Everyone descended safely, Tommy for the third time. With photographs in hand, he came home to Liam.



Buried to the waist in a snow-filled crevasse, photographer Tommy Heinrich climbs on.

PHOTO: RALF DUJMOVITS

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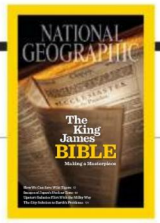
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King James Bible

Your story about the King James Bible brought back a pleasant memory from my college years in the mid-1970s. In my freshman year I took a course on 17th-century prose and poetry, taught by a soft-spoken true gentleman named Lowell Coolidge. The most demonstrative he ever got was when he was discussing the beauty of the English language as epitomized by the King James Bible and how the ability to write with such grace is waning. "We are losing it!" he said, pounding his podium with a resounding thud.

JOHN DILYARD
Brooklyn, New York

I understand that the original translators for the King James Version replaced "slave traders" with "men stealers" in I Timothy 1:10 to prevent repercussions from the nobility in England, many of whom financially benefited from the slave trade. In more modern versions, such as the New International Version, the verbiage follows the original Greek and states "slave traders." A recently retired missionary opined that had the KJV translators written that slave traders were an abomination in God's sight, slavery might never have come to America.

BEVERLY ELLIOTT
Clyde, North Carolina

William Tyndale dared to bypass the centuries-long insistence by church authorities that the Bible be written exclusively in Greek or Latin. Tyndale's purpose in doing so? He wanted to make it possible for "even a plowboy to know the Scriptures." While lengthily praising the KJV, the author limited to one sentence the courage and contribution of Tyndale, the first to translate the Bible into English.

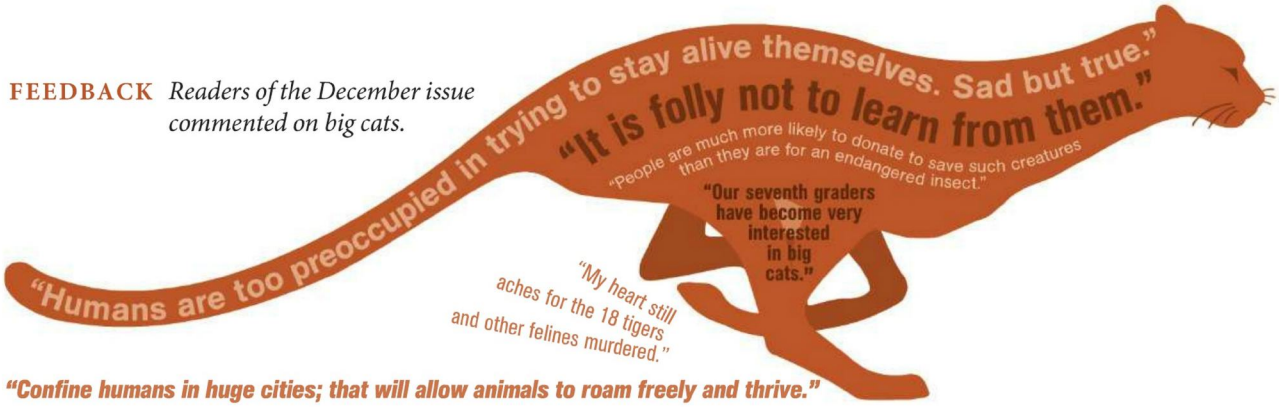
RON ULRICH
Vancouver, Washington

The church of Rodel (pages 40-41) is not on the Isle of Lewis as stated but on the Isle of Harris. This error can perhaps be excused: The Isles of Lewis and Harris, while enjoying separate identities, histories, and dialects of the Gaelic language, are part of the same landmass. The boundary between them is not represented on Ordnance Survey maps.

TRISTAN AP RHEINALLT
Stornoway, Isle of Lewis

We follow the naming conventions established in the National Geographic Atlas of the World, *ninth edition. Though we realize there is a very strong tradition locally that Harris and Lewis are two distinct areas, that distinction is not so clear-cut in the cartographic sense.*

FEEDBACK *Readers of the December issue commented on big cats.*



EMAIL ngsforum@ngm.com **TWITTER** @NatGeoMag **WRITE** National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199. Include name, address, and daytime telephone. Letters may be edited for clarity and length.

GRAPHIC: JUAN VELASCO, NGM STAFF

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† When taken twice daily.

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IMPORTANT INFORMATION ABOUT SYMBICORT

Important Safety Information About SYMBICORT for Asthma

SYMBICORT contains formoterol, a long-acting beta$_2$-adrenergic agonist (LABA). LABA medicines such as formoterol increase the risk of death from asthma problems. It is not known whether budesonide, the other medicine in SYMBICORT, reduces the risk of death from asthma problems seen with formoterol.
SYMBICORT should be used only if your health care provider decides that your asthma is not well controlled with a long-term asthma control medicine, such as an inhaled corticosteroid, or that your asthma is severe enough to begin treatment with SYMBICORT.

If you are taking SYMBICORT, see your health care provider if your asthma does not improve or gets worse. It is important that your health care provider assess your asthma control on a regular basis. Your doctor will decide if it is possible for you to stop taking SYMBICORT and start taking a long-term asthma control medicine without loss of asthma control.

Children and adolescents who take LABA medicines may have an increased risk of being hospitalized for asthma problems.

SYMBICORT does not replace rescue inhalers for sudden asthma symptoms.

Be sure to tell your health care provider about all your health conditions, including heart conditions or high blood pressure, and all medicines you may be taking. Some patients taking SYMBICORT may experience increased blood pressure, heart rate, or change in heart rhythm.

Do not use SYMBICORT more often than prescribed. While taking SYMBICORT, never use another medicine containing a LABA for any reason. Ask your health care provider or pharmacist if any of your other medicines are LABA medicines, as using too much LABA may cause chest pain, increase in blood pressure, fast and irregular heartbeat, headache, tremor, and nervousness.

Patients taking SYMBICORT should call their health care provider or get emergency medical care:

- if you experience serious allergic reactions including rash, hives, swelling of the face, mouth and tongue, and breathing problems.
- if you think you are exposed to infections such as chicken pox or measles, or if you have any signs of infection. You may have a higher chance of infection.
- if you experience an increase in wheezing right after taking SYMBICORT, eye problems including glaucoma and cataracts, decreases in bone mineral density, swelling of blood vessels (signs include a feeling of pins and needles or numbness of arms or legs, flu like symptoms, rash, pain, and swelling of the sinuses), decrease in blood potassium and increase in blood sugar levels.

If you are switching to SYMBICORT from an oral corticosteroid, follow your health care provider's instructions to avoid serious health risks when you stop using oral corticosteroids.

Common side effects include nose and throat irritation, headache, upper respiratory tract infection, sore throat, sinusitis, stomach discomfort, flu, back pain, nasal congestion, vomiting, and thrush in the mouth and throat.

Approved Uses for SYMBICORT for Asthma

SYMBICORT is a medicine for the treatment of asthma for people 12 years and older whose doctor has determined that their asthma is not well controlled with a long term asthma control medicine such as an inhaled corticosteroid or whose asthma is severe enough to begin treatment with SYMBICORT. SYMBICORT is not a treatment for sudden asthma symptoms.

Please see Important Product Information on adjacent page and discuss with your doctor.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch, or call 1-800-FDA-1088.

For more information, call 1-800-687-3755 or go to MySymbicort.com/info

If you're without prescription coverage and can't afford your medication, AstraZeneca may be able to help. For more information, please visit www.astrazeneca-us.com.

Symbicort®
(budesonide/formoterol fumarate dihydrate)
Inhalation Aerosol

AstraZeneca

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For commercially insured patients:

Patient: Present this free trial offer to your pharmacist, along with a valid prescription to receive a free 30-day supply (1 inhaler) of SYMBICORT. This offer is good for the purchase of one (1) SYMBICORT® (budesonide/formoterol fumarate dihydrate) inhaler and may be used by eligible patients 12 years of age and older who have commercial insurance. This offer may not be used for any other product and may not be combined with any other free trial, coupon, discount, prescription savings card, or other offer. Offer void in Massachusetts and where prohibited by law, taxed, or restricted. Not valid for mail orders, prescriptions purchased under Medicare, Medicaid, TRICARE, or similar federal or state programs, or if your insurance plan is paying the entire cost of the prescription. This offer is not health insurance. Not valid on refills. It is illegal for any person to sell, purchase, or trade this offer. This offer is valid only for product manufactured for AstraZeneca Pharmaceuticals LP and lawfully purchased from an authorized retailer or distributor in the United States or Puerto Rico. Offer must be presented with a valid prescription for SYMBICORT at the time of purchase, is limited to one (1) offer per person, and is not transferable. If you have insurance coverage, you will receive 100% off your copay for one (1) prescription of a SYMBICORT inhaler. Offer expires 06/30/2012. If you have questions regarding this offer, please call 1-800-236-9933. This offer may be changed or discontinued at any time without notice.

Pharmacist for a Patient With an Authorized Third-Party: Submit the claim to the primary Third-Party Payer first, then submit the balance due to **Therapy First Plus** as a Secondary Payer as a copay-only billing using a valid Other Coverage Code **(eg, 8)**. The patient is responsible for $0.00. Reimbursement will be received from **Therapy First Plus**. Valid Other Coverage Code Required: For any questions regarding **Therapy First Plus** online processing, please call the Help Desk at 1-800-422-5604. **This offer is not valid if reproduced. Prescriber ID# required on prescription.**

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You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch, or call 1-800-FDA-1088.

IMPORTANT INFORMATION ABOUT SYMBICORT

Please read this summary carefully and then ask your doctor about SYMBICORT.

No advertisement can provide all the information needed to determine if a drug is right for you or take the place of careful discussions with your health care provider. Only your health care provider has the training to weigh the risks and benefits of a prescription drug.

WHAT IS THE MOST IMPORTANT INFORMATION I SHOULD KNOW ABOUT SYMBICORT?

People with asthma who take long-acting beta$_2$-agonist (LABA) medicines, such as formoterol (one of the medicines in SYMBICORT), have an increased risk of death from asthma problems. It is not known whether budesonide, the other medicine in SYMBICORT, reduces the risk of death from asthma problems seen with formoterol.

SYMBICORT should be used only if your health care provider decides that your asthma is not well controlled with a long-term asthma control medicine, such as an inhaled corticosteroid, or that your asthma is severe enough to begin treatment with SYMBICORT.

Talk with your health care provider about this risk and the benefits of treating your asthma with SYMBICORT.

If you are taking SYMBICORT, see your health care provider if your asthma does not improve or gets worse. It is important that your health care provider assess your asthma control on a regular basis. Your doctor will decide if it is possible for you to stop taking SYMBICORT and start taking a long-term asthma control medicine without loss of asthma control.

Get emergency medical care if:

- breathing problems worsen quickly, and
- you use your rescue inhaler medicine, but it does not relieve your breathing problems.

Children and adolescents who take LABA medicines may be at increased risk of being hospitalized for asthma problems.

WHAT IS SYMBICORT?

SYMBICORT is an inhaled prescription medicine used for asthma and chronic obstructive pulmonary disease (COPD). It contains two medicines:

- Budesonide (the same medicine found in Pulmicort Flexhaler™, an inhaled corticosteroid). Inhaled corticosteroids help to decrease inflammation in the lungs. Inflammation in the lungs can lead to asthma symptoms
- Formoterol (the same medicine found in Foradil® Aerolizer®). LABA medicines are used in patients with COPD and asthma to help the muscles in the airways of your lungs stay relaxed to prevent asthma symptoms, such as wheezing and shortness of breath. These symptoms can happen when the muscles in the airways tighten. This makes it hard to breathe, which, in severe cases, can cause breathing to stop completely if not treated right away

SYMBICORT is used for asthma and chronic obstructive pulmonary disease as follows:

Asthma

SYMBICORT is used to control symptoms of asthma and prevent symptoms such as wheezing in adults and children ages 12 and older.

Chronic Obstructive Pulmonary Disease

COPD is a chronic lung disease that includes chronic bronchitis, emphysema, or both. SYMBICORT 160/4.5 mcg is used long-term, two times each day, to help improve lung function for better breathing in adults with COPD.

WHO SHOULD NOT USE SYMBICORT?

Do not use SYMBICORT to treat sudden severe symptoms of asthma or COPD or if you are allergic to any of the ingredients in SYMBICORT.

WHAT SHOULD I TELL MY HEALTH CARE PROVIDER BEFORE USING SYMBICORT?

Tell your health care provider about all of your health conditions, including if you:

- **have heart problems**
- **have high blood pressure**
- **have seizures**
- **have thyroid problems**
- **have diabetes**
- **have liver problems**
- **have osteoporosis**
- **have an immune system problem**
- **have eye problems such as increased pressure in the eye, glaucoma, or cataracts**
- **are allergic to any medicines**
- **are exposed to chicken pox or measles**
- **are pregnant or planning to become pregnant.** It is not known if SYMBICORT may harm your unborn baby
- **are breast-feeding.** Budesonide, one of the active ingredients in SYMBICORT, passes into breast milk. You and your health care provider should decide if you will take SYMBICORT while breast-feeding

Tell your health care provider about all the medicines you take including prescription and nonprescription medicines, vitamins, and herbal supplements. SYMBICORT and certain other medicines may interact with each other and can cause serious side effects. Know all the medicines you take. Keep a list and show it to your health care provider and pharmacist each time you get a new medicine.

HOW DO I USE SYMBICORT?

Do not use SYMBICORT unless your health care provider has taught you and you understand everything. Ask your health care provider or pharmacist if you have any questions.

Use SYMBICORT exactly as prescribed. **Do not use SYMBICORT more often than prescribed.** SYMBICORT comes in two strengths for asthma: 80/4.5 mcg and 160/4.5 mcg. Your health care provider will prescribe the strength that is best for you. SYMBICORT 160/4.5 mcg is the approved dosage for COPD.

- SYMBICORT should be taken every day as 2 puffs in the morning and 2 puffs in the evening.
- Rinse your mouth with water and spit the water out after each dose (2 puffs) of SYMBICORT. This will help lessen the chance of getting a fungus infection (thrush) in the mouth and throat.
- Do not spray SYMBICORT in your eyes. If you accidentally get SYMBICORT in your eyes, rinse your eyes with water. If redness or irritation persists, call your health care provider.
- Do not change or stop any medicines used to control or treat your breathing problems. Your health care provider will change your medicines as needed.
- **While you are using SYMBICORT 2 times each day, do not use other medicines that contain a long-acting beta$_2$-agonist (LABA) for any reason. Ask your health care provider or pharmacist if any of your other medicines are LABA medicines.**
- SYMBICORT does not relieve sudden symptoms. Always have a rescue inhaler medicine with you to treat sudden symptoms. If you do not have a rescue inhaler, call your health care provider to have one prescribed for you.

Call your health care provider or get medical care right away if:

- your breathing problems worsen with SYMBICORT
- you need to use your rescue inhaler medicine more often than usual
- your rescue inhaler does not work as well for you at relieving symptoms
- you need to use 4 or more inhalations of your rescue inhaler medicine for 2 or more days in a row
- you use one whole canister of your rescue inhaler medicine in 8 weeks' time
- your peak flow meter results decrease. Your health care provider will tell you the numbers that are right for you
- your symptoms do not improve after using SYMBICORT regularly for 1 week

WHAT MEDICATIONS SHOULD I NOT TAKE WHEN USING SYMBICORT?

While you are using SYMBICORT, do not use other medicines that contain a long-acting beta$_2$-agonist (LABA) for any reason, such as

- Serevent® Diskus® (salmeterol xinafoate inhalation powder)
- Advair Diskus® or Advair® HFA (fluticasone propionate and salmeterol)
- Formoterol-containing products such as Foradil Aerolizer, Brovana®, or Perforomist®

WHAT ARE THE POSSIBLE SIDE EFFECTS WITH SYMBICORT?

SYMBICORT can cause serious side effects.

- Increased risk of pneumonia and other lower respiratory tract infections if you have COPD. Call your health care provider if you notice any of these symptoms: increase in mucus production, change in mucus color, fever, chills, increased cough, increased breathing problems
- Serious allergic reactions including rash; hives; swelling of the face, mouth and tongue; and breathing problems. Call your health care provider or get emergency care if you get any of these symptoms
- Immune system effects and a higher chance for infections
- Adrenal insufficiency—a condition in which the adrenal glands do not make enough steroid hormones
- Cardiovascular and central nervous system effects of LABAs, such as chest pain, increased blood pressure, fast or irregular heartbeat, tremor, or nervousness
- Increased wheezing right after taking SYMBICORT
- Eye problems, including glaucoma and cataracts. You should have regular eye exams while using SYMBICORT
- Osteoporosis. People at risk for increased bone loss may have a greater risk with SYMBICORT
- Slowed growth in children. As a result, growth should be carefully monitored
- Swelling of your blood vessels. This can happen in people with asthma
- Decreases in blood potassium levels and increases in blood sugar levels

WHAT ARE COMMON SIDE EFFECTS OF SYMBICORT?

Patients with Asthma

Sore throat, headache, upper respiratory tract infection, thrush in the mouth and throat

Patients with COPD

Thrush in the mouth and throat

These are not all the side effects with SYMBICORT. Ask your health care provider or pharmacist for more information.

NOTE: This summary provides important information about SYMBICORT. For more information, please ask your doctor or health care provider.

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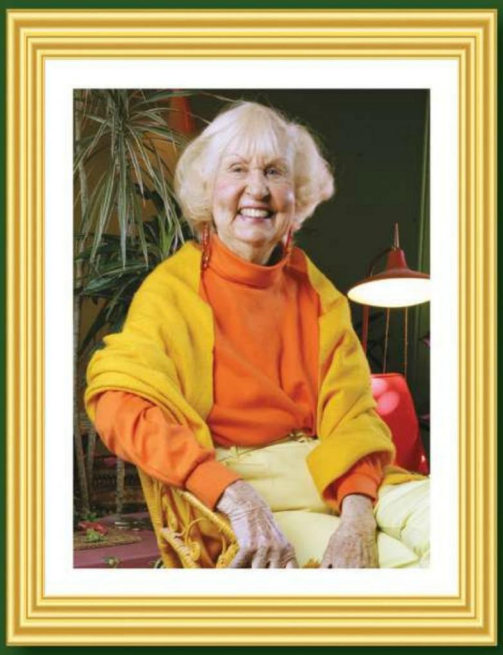
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Pat Minnick included National Geographic in her financial plans.

In 2007 Pat Minnick, a professional artist, decided to establish a charitable gift annuity to support National Geographic.

"I feel good knowing that National Geographic is doing so much to protect endangered wildlife," says Pat. "The environmental problems we face are vast, but by joining with National Geographic and their history of remarkable accomplishments, I know we can pass on a more beautiful world."

Pat now receives a guaranteed life income and is a direct part of the Society's efforts to inspire people to care about the planet.

For more information about a charitable gift annuity or other ways to include National Geographic in your estate plans, please see below.

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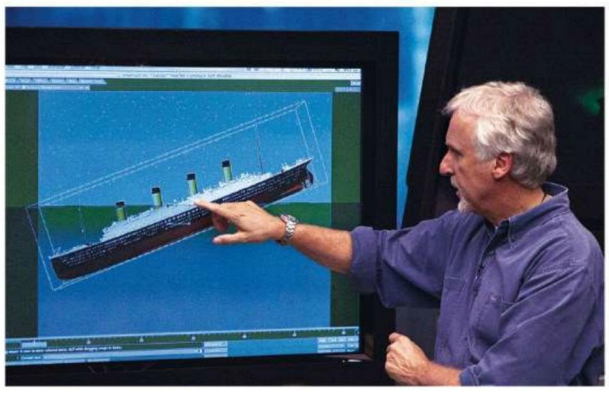


THIS MONTH

Python Hunters

First they worked to rid the Florida Everglades of invasive Burmese pythons. Now python breeder Michael Cole, biologist Shawn Heflick, and law enforcement officer Greg Graziani are on a mission to protect snakes and other reptiles in their natural habitats around the world. Follow the trio to Costa Rica, where they capture crocodiles feeding in a fish farm and size up venomous eyelash vipers. See what other slithering subjects await them in Peru, Australia, and Thailand in this new series airing this month on Nat Geo WILD.

From left to right (top), Michael Cole, Shawn Heflick, and Greg Graziani hold Burmese pythons near the Everglades.



NATIONAL GEOGRAPHIC CHANNEL

Titanic: The Final Word With James Cameron

National Geographic Explorer-in-Residence James Cameron (above) leads a forensic investigation to determine how the *Titanic* sank.

For listings go to **natgeotv.com** and **natgeowild.com.**

PHOTOS: CINEFLIX, ZACHARY MAXWELL STERTZ (TOP); LIGHTSTORM

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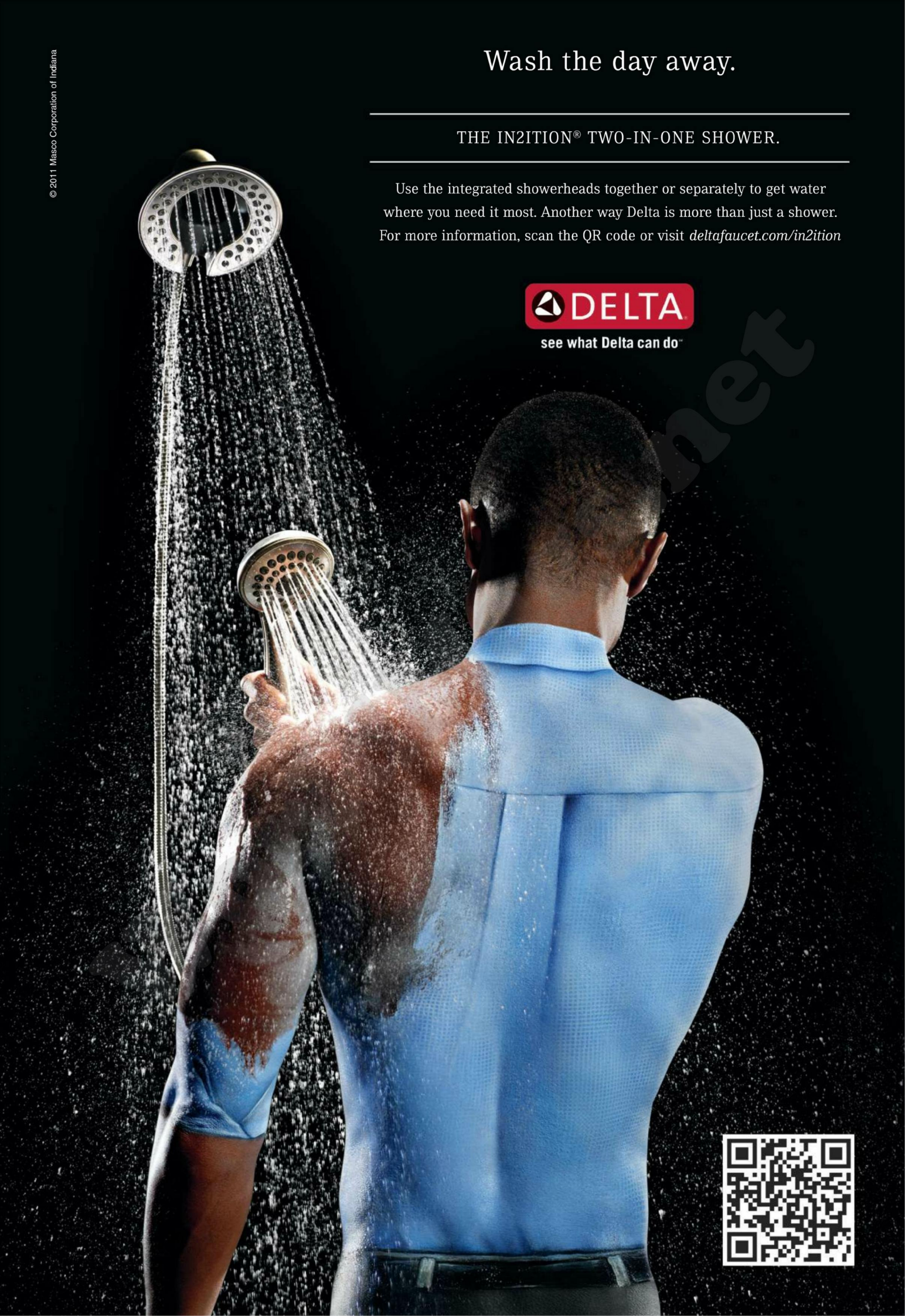
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MISSION *To explore and inspire discovery in the world's oceans*

Titanic's Titan

I saw the search for the *Titanic* as a scientific challenge. But it was not until I actually discovered it—on September 1, 1985, at 1 a.m.—that it spoke to me in a way that surprised me. I'd entered a piece of history. I feel connected to it now, the memory of it, but I'm more tied to the people than to the ship: the people of Belfast who built it, those who lost their lives on it, and survivors like Eva Hart, a seven-year-old passenger who lost her father. She died at 91 as one of the oldest survivors. We became friends. "That's my father's grave," she once told me. "Don't disturb it." And I agree. Why desecrate the site? Technology will let us explore it remotely someday. The *Titanic* is more than what people who bring up artifacts for display see. The place is just as important as an object from the place.

These days, my deep-sea work goes at a faster pace than ever. My ship of exploration, the *E/V Nautilus,* is giving us an unprecedented view of the oceans. We found 40 wrecks in the past two seasons alone. In the Black Sea we were finding one each day, including perfectly preserved wrecks from the Greek classical era. We've accelerated discovery. I haven't a clue what else we'll find—but that's just it. I'll discover whatever is there. We've seen one-tenth of one percent of what's out there, and maybe I'll find one percent. It's a continuum, and *Titanic* was a step along the way. *—Robert Ballard*



"Every generation rediscovers the *Titanic,*" says Ballard, here in 2003 on the research ship that enabled the wreck's find.
▶ *Watch* Save the Titanic With Bob Ballard *this month on National Geographic Channel.*

PHOTO: DAVID McLAIN



DIABETES DAMAGES NERVES

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*Individual results may vary. †Those who have had a drug or alcohol problem are more likely to misuse Lyrica.

Prescription Lyrica is not for everyone. Tell your doctor right away about any serious allergic reaction that causes swelling of the face, mouth, lips, gums, tongue, throat or neck or any trouble breathing or that affects your skin. Lyrica may cause suicidal thoughts or actions in a very small number of people. Call your doctor right away if you have new or worsening depression, suicidal thoughts or actions, or unusual changes in mood or behavior. Lyrica may cause swelling of your hands, legs and feet. Some of the most common side effects of Lyrica are dizziness and sleepiness. Do not drive or work with machines until you know how Lyrica affects you. Other common side effects are blurry vision, weight gain, trouble concentrating, dry mouth, and feeling "high." Also, tell your doctor right away about muscle pain along with feeling sick and feverish, or any changes in your eyesight including blurry vision or any skin sores if you have diabetes. You may have a higher chance of swelling, hives or gaining weight if you are also taking certain diabetes or high blood pressure medicines. Do not drink alcohol while taking Lyrica. You may have more dizziness and sleepiness if you take Lyrica with alcohol, narcotic pain medicines, or medicines for anxiety. If you have had a drug or alcohol problem, you may be more likely to misuse Lyrica. Tell your doctor if you are planning to father a child. Talk with your doctor before you stop taking Lyrica or any other prescription medication.

Please see Important Risk Information for Lyrica on the following page.

To learn more visit www.lyrica.com or call toll-free 1-888-9-LYRICA (1-888-959-7422).

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

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IMPORTANT FACTS

LYRICA® PREGABALIN capsules

(LEER-i-kah)

IMPORTANT SAFETY INFORMATION ABOUT LYRICA

LYRICA may cause serious, even life threatening, allergic reactions. Stop taking LYRICA and call your doctor right away if you have any signs of a serious allergic reaction:

- Swelling of your face, mouth, lips, gums, tongue, throat or neck
- Have any trouble breathing
- Rash, hives (raised bumps) or blisters

Like other antiepileptic drugs, LYRICA may cause suicidal thoughts or actions in a very small number of people, about 1 in 500.

Call your doctor right away if you have any symptoms, especially if they are new, worse or worry you, including:

- New or worsening depression
- Suicidal thoughts or actions
- Unusual changes in mood or behavior

Do not stop LYRICA without first talking with your doctor.

LYRICA may cause swelling of your hands, legs and feet.

This swelling can be a serious problem with people with heart problems.

LYRICA may cause dizziness or sleepiness.

Do not drive a car, work with machines, or do other dangerous things until you know how LYRICA affects you. Ask your doctor when it is okay to do these things.

ABOUT LYRICA

LYRICA is a prescription medicine used in adults 18 years and older to treat:

- Pain from damaged nerves that happens with diabetes or that follows healing of shingles
- Partial seizures when taken together with other seizure medicines
- Fibromyalgia (pain all over your body)

Who should NOT take LYRICA:

- Anyone who is allergic to anything in LYRICA

BEFORE STARTING LYRICA

Tell your doctor about all your medical conditions, including if you:

- Have had depression, mood problems or suicidal thoughts or behavior
- Have or had kidney problems or dialysis
- Have heart problems, including heart failure
- Have a bleeding problem or a low blood platelet count
- Have abused prescription medicines, street drugs or alcohol in the past
- Have ever had swelling of your face, mouth, tongue, lips, gums, neck, or throat (angioedema)
- Plan to father a child. It is not known if problems seen in animal studies can happen in humans.
- Are pregnant, plan to become pregnant or are breastfeeding. It is not known if LYRICA will harm your unborn baby. You and your doctor should decide whether you should take LYRICA or breast-feed, but not both.

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal supplements.

LYRICA and other medicines may affect each other causing side effects. Especially tell your doctor if you take:

- Angiotensin converting enzyme (ACE) inhibitors. You may have a higher chance for swelling and hives.

BEFORE STARTING LYRICA, continued

- Avandia® (rosiglitazone)*, Avandamet® (rosiglitazone and metformin)* or Actos® (pioglitazone)** for diabetes. You may have a higher chance of weight gain or swelling of your hands or feet.
- Narcotic pain medicines (such as oxycodone), tranquilizers or medicines for anxiety (such as lorazepam). You may have a higher chance for dizziness and sleepiness.
- Any medicines that make you sleepy

POSSIBLE SIDE EFFECTS OF LYRICA

LYRICA may cause serious side effects, including:

- See "Important Safety Information About LYRICA."
- Muscle problems, pain, soreness or weakness along with feeling sick and fever
- Eyesight problems including blurry vision
- Weight gain. Weight gain may affect control of diabetes and can be serious for people with heart problems.
- Feeling "high"

If you have any of these symptoms, tell your doctor right away.

The most common side effects of LYRICA are:

- Dizziness
- Blurry vision
- Weight gain
- Sleepiness
- Trouble concentrating
- Swelling of hands and feet
- Dry mouth

If you have diabetes, you should pay extra attention to your skin while taking LYRICA and tell your doctor of any sores or skin problems.

HOW TO TAKE LYRICA

Do:

- Take LYRICA exactly as your doctor tells you. Your doctor will tell you how much to take and when to take it. Take LYRICA at the same times each day.
- Take LYRICA with or without food.

Don't:

- Drive a car or use machines if you feel dizzy or sleepy while taking LYRICA.
- Drink alcohol or use other medicines that make you sleepy while taking LYRICA.
- Change the dose or stop LYRICA suddenly. You may have headaches, nausea, diarrhea, or trouble sleeping if you stop taking LYRICA suddenly.
- Start any new medicines without first talking to your doctor.

NEED MORE INFORMATION?

- Ask your doctor or pharmacist. This is only a brief summary of important information.
- Go to **www.lyrica.com** or call **1-866-459-7422 (1-866-4LYRICA).**

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In the Galápagos Islands, a photographer captures a giant tortoise in the highlands of Santa Cruz.

VISIONS



Spain
A poppy's ardent color provides the perfect complement to a brilliantly hued *Psilothrix* beetle. Springtime foraging is common for the insect in the semidesert Bardenas Reales, a UNESCO biosphere reserve.

PHOTO: JOSÉ ANTONIO MARTÍNEZ





United States
On Fourth Lake in New York's Adirondacks, a crush of 1,902 canoes and kayaks attempts to break a "largest raft" world record. Rules dictate that the mega-structure float freely for at least 30 seconds, held together only by hands.

PHOTO: NANCIE BATTAGLIA, *SPORTS ILLUSTRATED*/GETTY IMAGES





Greenland
Snow-covered ice saturated with winter twilight sets the stage for recreational soccer in the village of Aappilattoq. Athletic moves in bundles of warm clothing can prove more challenging than maneuvering on the frozen surface.

PHOTO: ANDREA GJESTVANG, MOMENT

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This page features two photographs: one chosen by our editors and one chosen by our readers via online voting. For more information, go to *ngm.com/yourshot.*



EDITORS' CHOICE **Paul Hennessy** Orlando, Florida

Hennessy, 58, has "a passion for photographing wildlife, and anything strange and unusual." A two-headed albino Honduran milk snake filled both bills. Hennessy photographed the "serpent oddity"—owned by a local university biologist—on a black T-shirt at a Florida breeding facility.



READERS' CHOICE

Chris Kotsiopoulos
Athens, Greece

A severe thunderstorm sparked the imagination of Kotsiopoulos, 39. On Ikaria island he set his camera on a tripod and took repeated 20-second exposures, then combined 70 of them into a single frame. "After 83 minutes," he says, "I ended up with this wall of lightning!"



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SANOFI DIABETES Going beyond together

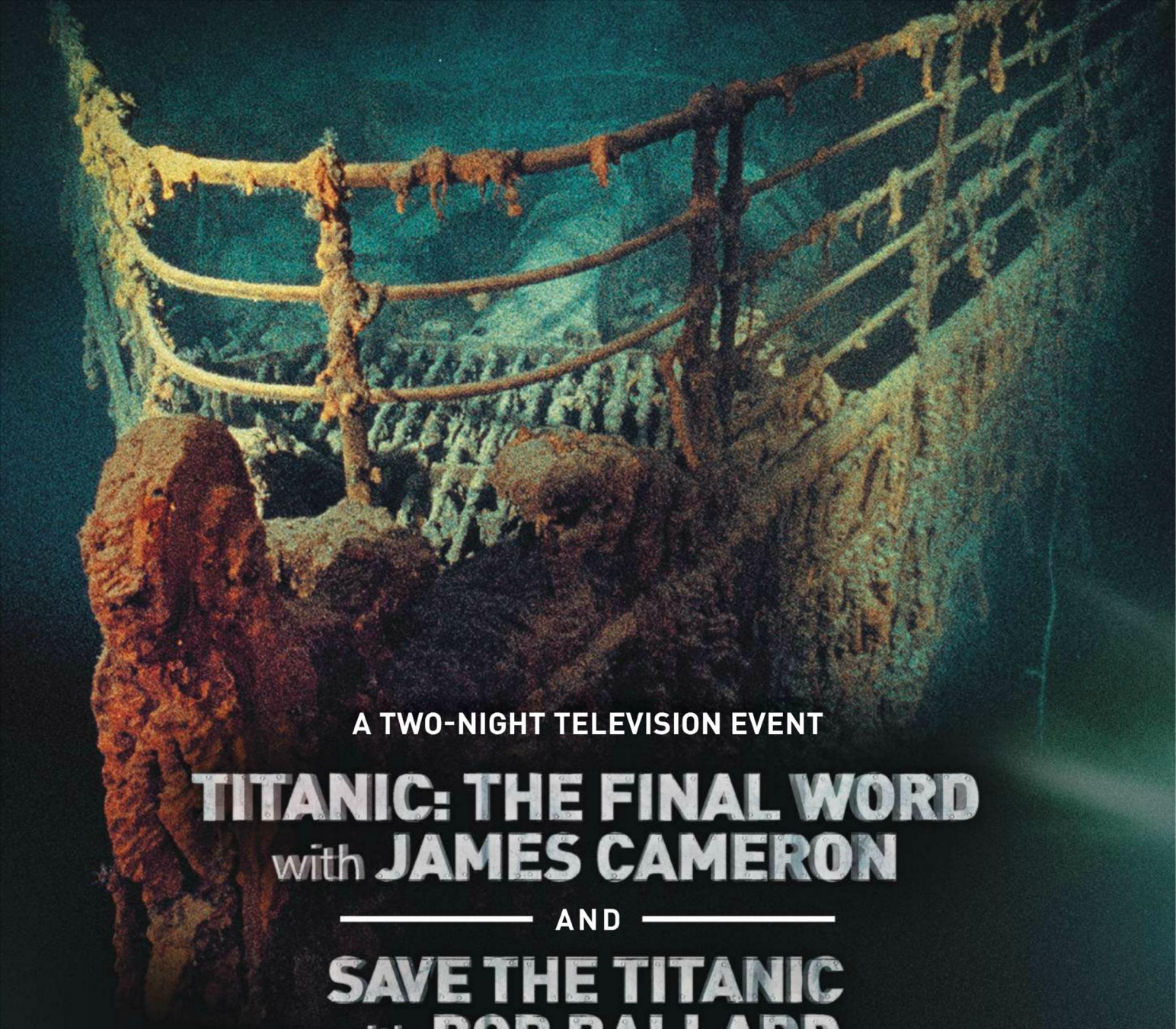
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Important Safety Information About Insulin:
The most common side effect of insulin is low blood sugar. Some people may experience symptoms such as shaking, sweating, fast heartbeat, and blurred vision, while some experience no symptoms at all. That's why it's important to check your blood sugar often. Talk to your doctor about whether insulin is right for you.

Learn more at UnderstandBloodSugarControl.com or call 1.866.923.0210.



A TWO-NIGHT TELEVISION EVENT

TITANIC: THE FINAL WORD with JAMES CAMERON

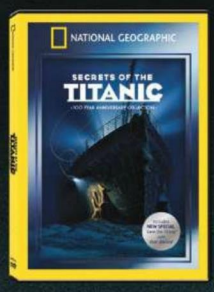
AND

SAVE THE TITANIC with BOB BALLARD

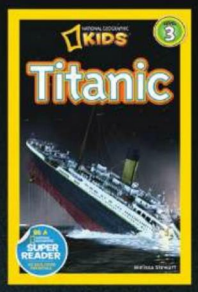
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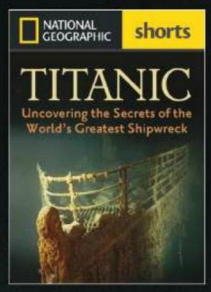
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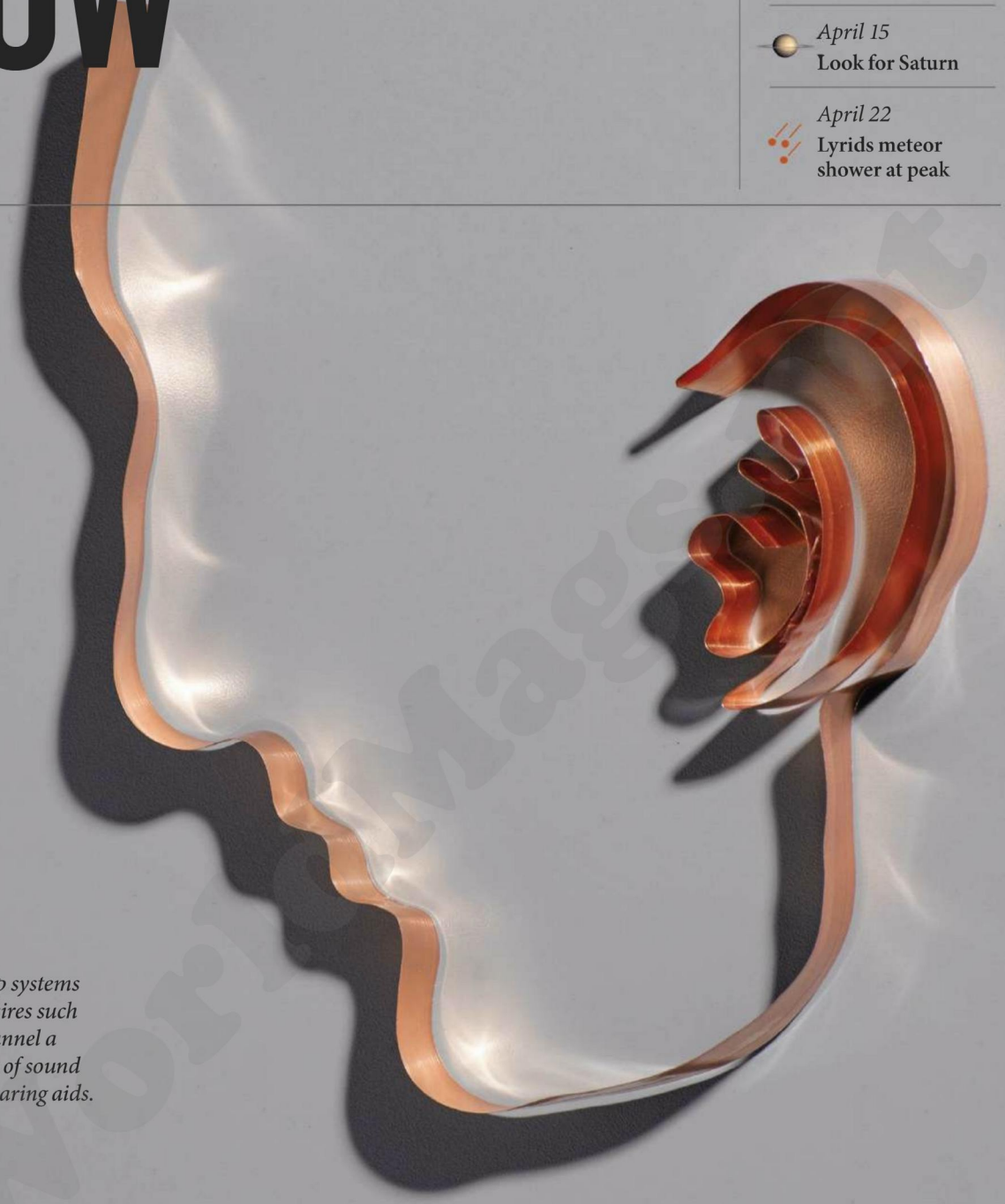
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Hearing-loop systems use copper wires such as this to channel a single source of sound directly to hearing aids.

Sound Effects

Imagine flipping a switch to cut out muddling background noise so all you hear is a speaker's voice. For millions of people with hearing difficulties, it's now possible with hearing loops—a simple technology appearing in U.S. airports, churches, auditoriums, and other venues. Already widespread in the U.K. and Scandinavian nations, the system takes advantage of a common hearing aid component called a telecoil. Loops don't require headsets or receivers like other assistive methods; the magic lies in wire loops installed at the site. These relay magnetic signals to the telecoil from an amplifier linked to the audio source, typically a microphone or public address system. Activate the aid's "T" setting (originally for "telephone mode") and it's like a voice crystallizes inside your head. This year New York City expects to have all 455 staffed subway booths looped, joining the London Underground in enabling the hard of hearing to rise above the clatter and din. *—Luna Shyr*

PHOTO: MARK THIESSEN, NGM STAFF. ART: JEANNE M. MODDERMAN, NGM STAFF

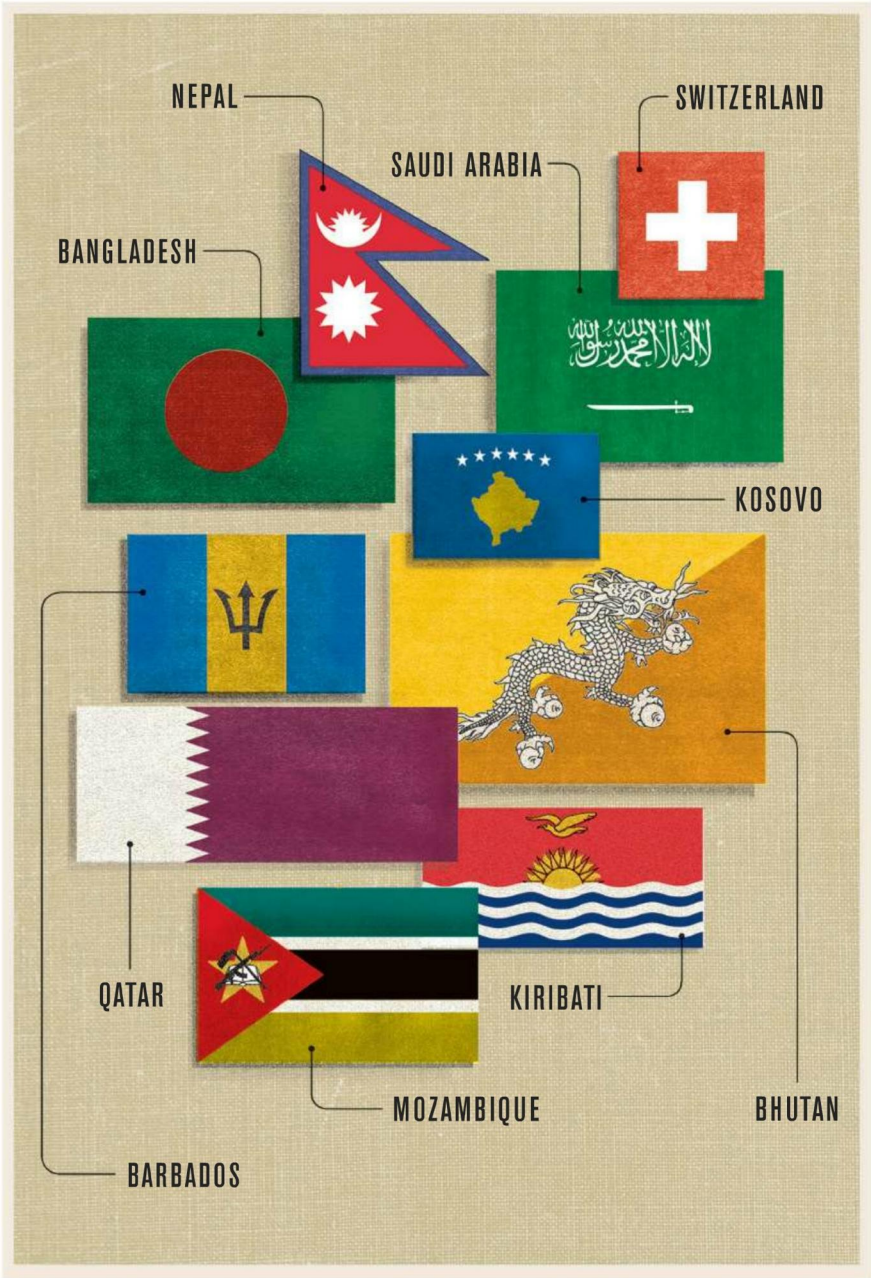
Flags of the World Today

South Sudan won independence, and Libya's power has shifted, putting new national flags in the news (below). But what does a flag really mean?

"It always represents identity," says Graham Bartram of the U.K.'s Flag Institute. "But identity is open to interpretation." Meaning a flag may be designed by contest or committee. The challenge: to distill a nation's essence—values, beliefs, traditions—into just a few shapes and colors.

Bartram says modern flag aesthetics have evolved over millennia from coats of arms. If you're a flag designer today, aka a vexillographer, try applying these five hallowed principles: simplicity, distinctiveness, no lettering, two or three colors, only meaningful symbols. Then see how it flies.

—Jeremy Berlin



A selective sampling of national flags highlights the unique and unusual (below).



Former Libyan flag (1977-2011)



New Libyan flag (2011)

Symbols

Symbols reflect culture or history, geography or religion. Barbados's flag bears a trident, Bhutan's a dragon, Mozambique's a firearm. Kosovo's shows the country's silhouette.

Shapes

Some flags deviate from the standard rectangular shape. Examples include Qatar's elongated horizontal, Nepal's stacked triangles, and Switzerland's perfect square.

Details

Off-center designs adorn several flags, including Bangladesh's. Kiribati's replicates a coat of arms, and Saudi Arabia's two sides are not a mirror image of each other.

ART: OLIVER MUNDAY

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Rafting inverted, the violet Janthina *snails (here with hitchhiking goose barnacles) lack gravity-sensing organs.*

Bubble-Rafting Snails

For almost all snails, foot slime is a tool for locomotion or for sending chemical messages. A not-even-an-inch-size marine family called Janthinidae has a more splendid stratagem for its mucus—it uses it to form a raft of bubbles to buoy it at the top of the ocean. The method is adroit: The snail folds its foot around a pocket of air, then attaches the newly formed bubble to the rest to extend its raft. The most prolific can produce about one mucus orb per minute.

Janthinidae are all sequentially hermaphroditic (they'll become females at adulthood), but the rigor of pre-rafting life varies. The juvenile male of the rarest genus, *Recluzia,* lives all but effortlessly for a while, attaching to a rafting female. But the benefits aren't all one-sided. "The male has a place to stay, and they both have a chance to reproduce," says biologist Celia Churchill of the University of Michigan. Other genera are set adrift as soon as propagation is complete—the larvae of *Janthina janthina* tumble into the ocean after being born, bobbing until able to raft on their own. *—Johnna Rizzo*

PHOTO: DENIS REIK

worldmags.net

About a thousand letters arrive in Jerusalem every year addressed to God.



Breaking the Ice

Bowhead whales are big, fat, and slow, but they are adventurous. Scientists believe they're pioneers in traversing a newly reopened Arctic sea route created by melting ice. Researchers tracking whale populations in the Atlantic near Greenland and in the Pacific near Alaska discovered that a tagged male from each side entered the Northwest Passage in the summer of 2010. Their paths remained in the crossover area (map) for about ten days. Although the two populations have likely been separated by ice for millennia, their genetic differences aren't large, suggesting periodic encounters during that time, says Mads Peter Heide-Jørgensen of the Greenland Institute of Natural Resources. He and colleagues are keen to see how frequently the whales meet in the middle. "With less ice in the Northwest Passage there will probably be more whales that make that move—and maybe other species as well." *—Murray Carpenter*



Researchers must approach within a dozen feet or so of bowhead whales to place satellite tags on their backs.



Defined by the seas in which they live, two of four bowhead whale populations mixed in 2010 when ice receded.

SCALE VARIES IN THIS PERSPECTIVE.

MAP: JEROME N. COOKSON, NGM STAFF. SOURCES: RANDALL REEVES, OKAPI WILDLIFE ASSOCIATES; NATIONAL MARINE MAMMAL LABORATORY, NOAA; NATIONAL SNOW AND ICE DATA CENTER

PHOTO: MADS PETER HEIDE-JØRGENSEN

GRAPHIC: KISS ME I'M POLISH
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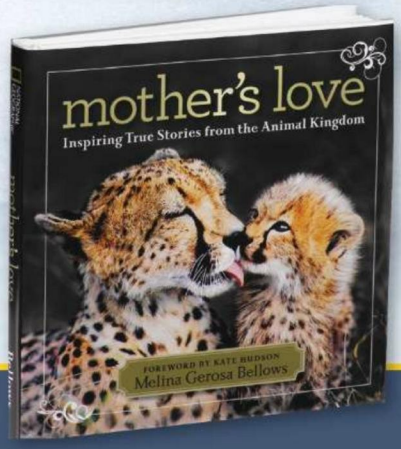
Go Wild!

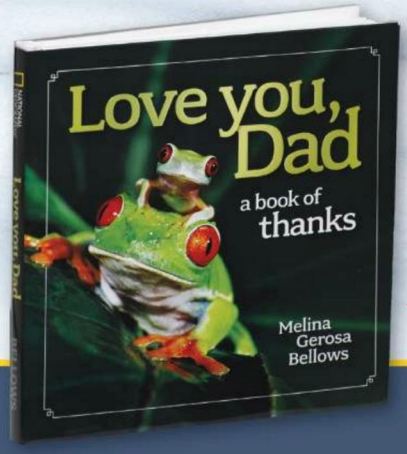


From Acadia to Zion, all the inspiration you need to plan your next parks adventure can be found in the new *National Geographic Guide to the National Parks of the U.S.* Filled with photos, maps, itineraries, activities, and expert advice, it's America's most popular guide to all 58 scenic national parks.

Inspiring true tales from the animal kingdom

Heartwarming stories and sentiments paired with adorable photos make the perfect affordable gift books to show Moms and Dads how much you care.





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When a laser zaps a gem, a unique light spectrum is released. It can be analyzed to trace the rock's origin.

Gemstone DNA

"Blood diamonds" and "conflict minerals" are mined in war zones and used to finance brutal armed groups around the world. Now a new way of pinpointing a stone's provenance may help prevent the illicit trade. The Texas-based firm Materialytics reports more than 95 percent accuracy in identifying the origin of everything from rubies to rough emeralds to minerals used in cell phones.

The novel process begins when a laser beam converts a tiny amount of the rock into a bright micro-plasma, generating a spark recorded by a spectrometer. The light's wavelengths create a unique spectral sequence, which is then detailed to two million data points per sample. Within minutes a tester knows if there's a match in the firm's database, which now contains 50,000-plus collected samples from more than 60 countries—some down to the exact mine where a gem originated.

The technology is timely. Pending U.S. laws could require importers to disclose whether products contain certain minerals from conflict regions. And the UN-endorsed Kimberley Process—a voluntary government-industry pact to keep blood diamonds off the retail market—is drawing fire for loopholes. Precise geology may be the key to pulling diamonds from the global rough. *—Erin Friar McDermott*

PHOTO: MARK THIESSEN, NGM STAFF



Squid skin can change color and pattern in just 700 milliseconds. Here a male *Doryteuthis opalescens* grasping a female turns red to repel other suitors.

Shade Shifters

Everyone knows chameleons can change colors. To scientists exploring the future of mutable materials, however, octopuses, cuttlefish, and squid (above) are the true masters. With split-second shifts in skin color and patterning, these cephalopods elude predators with near-perfect camouflage against rocks or reefs. The trick lies in the neural control of millions of pigmented skin organs and light-reflecting cells.

Now biologists think that opsins—light-sensing proteins found in eyes—also play a role. A team led by Roger Hanlon of the Woods Hole Marine Biological Laboratory discovered that a particular opsin in cephalopods' eyes resides in their skin as well. With funding from the U.S. Office of Naval Research, Hanlon is further probing the depths of disguise with Rice University engineers. They hope insights will yield novel materials, such as plastics or wallpaper that can morph from, say, red stripes to checkerboard at the flip of an electrical switch. "Chameleons are very cool," says Hanlon, "but they're a bit boring compared to cephalopods." *—Luna Shyr*

THE LIST

Gun Salute

The U.S. military fires cannon during ceremonial gun salutes. The honoree's position determines the number used. Here are some examples.

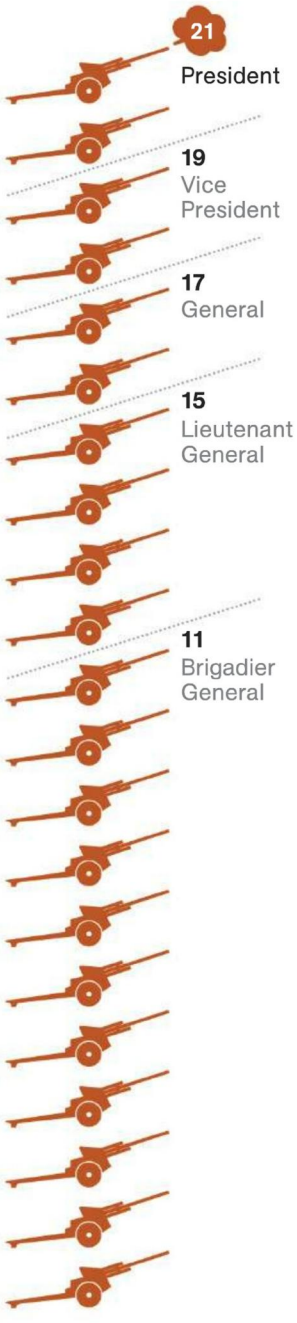


PHOTO: BRIAN SKERRY, NATIONAL GEOGRAPHIC STOCK. GRAPHIC: NGM ART. SOURCE: DEPARTMENT OF DEFENSE

For arthritis patients, it's simple physics:

A body in motion tends to stay in motion.



Celebrex can help relieve arthritis pain...so you can keep moving.

Staying active can actually relieve arthritis symptoms. But if you have arthritis, staying active can be difficult. Celebrex can help relieve arthritis pain...so *your* body can stay in motion.

- **Just one 200mg Celebrex a day can provide 24-hour relief for many with arthritis pain and inflammation.***
- **Celebrex is proven to improve pain, stiffness and daily physical function in clinical studies.****
- **Celebrex is not a narcotic.**

When it comes to finding the right arthritis treatment for you, you and your doctor need to balance the benefits with the risks. So ask your doctor about prescription Celebrex. It could be an important step towards keeping *your* body in motion.

Visit **celebrex.com** or call 1-888-CELEBREX for more information.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

*Individual results may vary. **Clinical studies with osteoarthritis patients.

Important Safety Information:

All prescription NSAIDs, like CELEBREX, ibuprofen, naproxen and meloxicam have the same cardiovascular warning. They may all increase the chance of heart attack or stroke, which can lead to death. This chance increases if you have heart disease or risk factors for it, such as high blood pressure or when NSAIDs are taken for long periods.

CELEBREX should not be used right before or after certain heart surgeries.

Serious skin reactions, or stomach and intestine problems such as bleeding and ulcers, can occur without warning and may cause death. Patients taking aspirin and the elderly are at increased risk for stomach bleeding and ulcers.

Tell your doctor if you have: a history of ulcers or bleeding in the stomach or intestines; high blood pressure or heart failure; or kidney or liver problems.

CELEBREX should not be taken in late pregnancy.

Life-threatening allergic reactions can occur with CELEBREX. Get help right away if you've had swelling of the face or throat or trouble breathing. Do not take it if you've had an asthma attack, hives, or other allergies to aspirin, other NSAIDs or certain drugs called sulfonamides.

Prescription CELEBREX should be used exactly as prescribed at the lowest dose possible and for the shortest time needed.

See the Medication Guide on the next page for important information about Celebrex and other prescription NSAIDs.

Pfizer helpful answers

Uninsured? Need help paying for Pfizer medicines?
Pfizer has programs that can help. Call **1-866-706-2400** or visit **PfizerHelpfulAnswers.com**

CELEBREX® (CELECOXIB CAPSULES) 100 mg 200 mg

For a body in motion™

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Medication Guide
for
Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

(See the end of this Medication Guide for a list of prescription NSAID medicines.)

What is the most important information I should know about medicines called Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines may increase the chance of a heart attack or stroke that can lead to death.

This chance increases:

- with longer use of NSAID medicines
- in people who have heart disease

NSAID medicines should never be used right before or after a heart surgery called a "coronary artery bypass graft (CABG)."

NSAID medicines can cause ulcers and bleeding in the stomach and intestines at any time during treatment. Ulcers and bleeding:

- can happen without warning symptoms
- may cause death

The chance of a person getting an ulcer or bleeding increases with:

- taking medicines called "corticosteroids" and "anticoagulants"
- longer use
- smoking
- drinking alcohol
- older age
- having poor health

NSAID medicines should only be used:

- exactly as prescribed
- at the lowest dose possible for your treatment
- for the shortest time needed

What are Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines are used to treat pain and redness, swelling, and heat (inflammation) from medical conditions such as:

- different types of arthritis
- menstrual cramps and other types of short-term pain

Who should not take a Non-Steroidal Anti-Inflammatory Drug (NSAID)?

Do not take an NSAID medicine:

- if you had an asthma attack, hives, or other allergic reaction with aspirin or any other NSAID medicine
- for pain right before or after heart bypass surgery

Tell your healthcare provider:

- about all of your medical conditions.
- about all of the medicines you take. NSAIDs and some other medicines can interact with each other and cause serious side effects. **Keep a list of your medicines to show to your healthcare provider and pharmacist.**
- if you are pregnant. **NSAID medicines should not be used by pregnant women late in their pregnancy.**
- if you are breastfeeding. **Talk to your doctor.**

What are the possible side effects of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

Serious side effects include:

- heart attack
- stroke
- high blood pressure
- heart failure from body swelling (fluid retention)
- kidney problems including kidney failure
- bleeding and ulcers in the stomach and intestine
- low red blood cells (anemia)
- life-threatening skin reactions
- life-threatening allergic reactions
- liver problems including liver failure
- asthma attacks in people who have asthma

Other side effects include:

- stomach pain
- constipation
- diarrhea
- gas
- heartburn
- nausea
- vomiting
- dizziness

Get emergency help right away if you have any of the following symptoms:

- shortness of breath or trouble breathing
- chest pain
- weakness in one part or side of your body
- slurred speech
- swelling of the face or throat

Stop your NSAID medicine and call your healthcare provider right away if you have any of the following symptoms:

- nausea
- more tired or weaker than usual
- itching
- your skin or eyes look yellow
- stomach pain
- flu-like symptoms
- vomit blood
- there is blood in your bowel movement or it is black and sticky like tar
- skin rash or blisters with fever
- unusual weight gain
- swelling of the arms and legs, hands and feet

These are not all the side effects with NSAID medicines. Talk to your healthcare provider or pharmacist for more information about NSAID medicines.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

Other information about Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

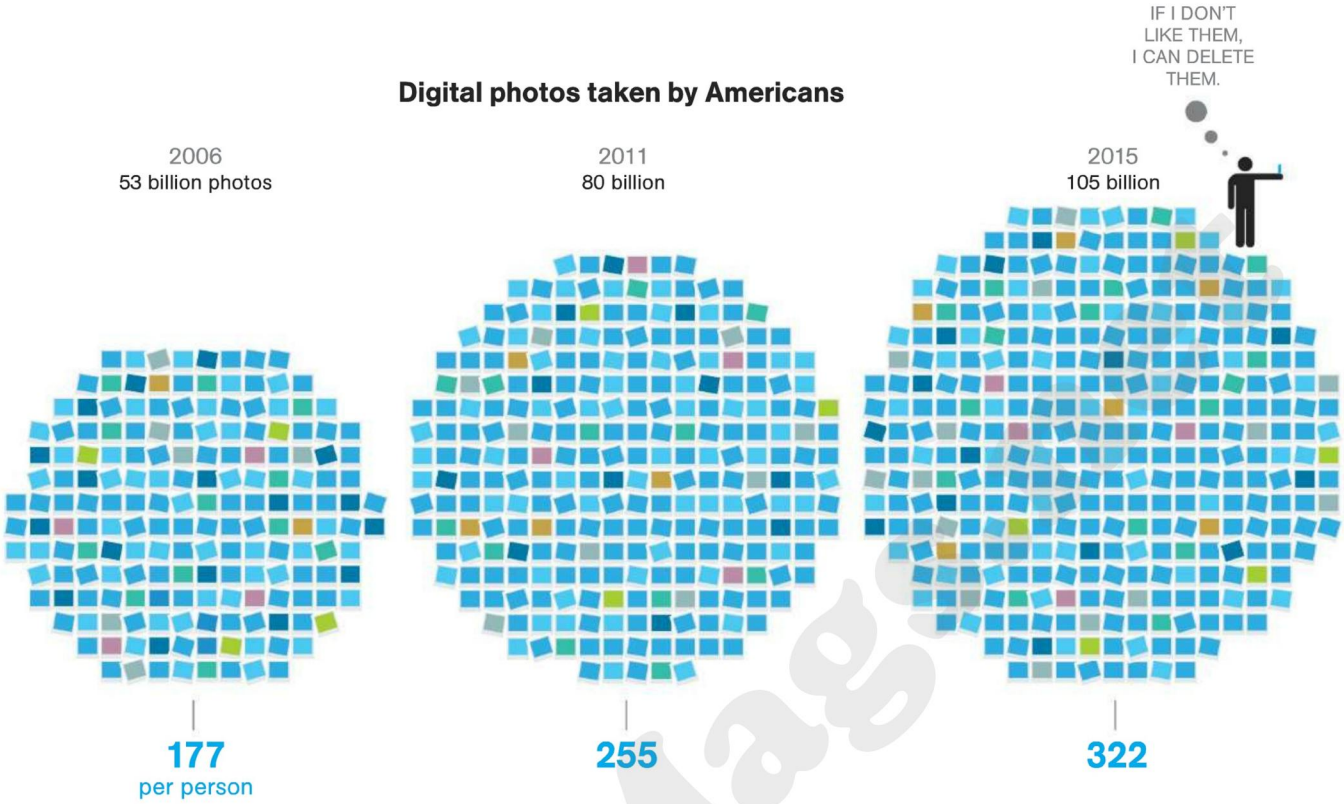
- Aspirin is an NSAID medicine but it does not increase the chance of a heart attack. Aspirin can cause bleeding in the brain, stomach, and intestines. Aspirin can also cause ulcers in the stomach and intestines.
- Some of these NSAID medicines are sold in lower doses without a prescription (over-the-counter). Talk to your healthcare provider before using over-the-counter NSAIDs for more than 10 days.

NSAID medicines that need a prescription

Generic Name	Tradename
Celecoxib	Celebrex
Diclofenac	Cataflam, Voltaren, Arthrotec (combined with misoprostol)
Diflunisal	Dolobid
Etodolac	Lodine, Lodine XL
Fenoprofen	Nalfon, Nalfon 200
Flurbiprofen	Ansaid
Ibuprofen	Motrin, Tab-Profen, Vicoprofen* (combined with hydrocodone), Combunox (combined with oxycodone)
Indomethacin	Indocin, Indocin SR, Indo-Lemmon, Indomethagan
Ketoprofen	Oruvail
Ketorolac	Toradol
Mefenamic Acid	Ponstel
Meloxicam	Mobic
Nabumetone	Relafen
Naproxen	Naprosyn, Anaprox, Anaprox DS, EC-Naproxyn, Naprelan, Naprapac (copackaged with lansoprazole)
Oxaprozin	Daypro
Piroxicam	Feldene
Sulindac	Clinoril
Tolmetin	Tolectin, Tolectin DS, Tolectin 600

* Vicoprofen contains the same dose of ibuprofen as over-the-counter (OTC) NSAIDs, and is usually used for less than 10 days to treat pain. The OTC NSAID label warns that long term continuous use may increase the risk of heart attack or stroke.

This Medication Guide has been approved by the U.S. Food and Drug Administration.





Shutterbugs are increasingly turning to camera phones, which in 2011 accounted for 37 percent of Americans' digital photos. By 2015 that share could be close to half.

Image Obsessed

We've gone snap happy: Surveys of consumers' photography habits show an explosion in image quantity with the shift from film to digital. "Not thinking about cost has allowed people to be more creative," says Ed Lee, photo services director at the market research firm InfoTrends. What's the negative? Culling and keeping track of all those digital files takes time but matters even more as storage technology changes. "Backing up images is like flossing," says Lee. "You don't want to, but know you should." ***—Amanda Fiegl***

ET CETERA

A **TISSUE-ENGINEERED SMALL INTESTINE** for mice could lead to human organ regeneration, say California researchers. ▪ European astronomers have discovered the **MOST DISTANT KNOWN QUASAR,** a black-hole-powered object that is 60 trillion times as bright as the sun. ▪ U.K. scientists sequenced the **NAKED MOLE RAT'S GENOME** to study the rodent's longevity and cancer resistance. ▪ **NEW ELEMENTS** added to the periodic table, numbered 114 and 116, have proposed names of flerovium (Fl) and livermorium (Lv).

GRAPHIC: ÁLVARO VALIÑO. SOURCE: INFOTRENDS
PHOTO: MARK THIESSEN, NGM STAFF; ZIA SOLEIL, GETTY IMAGES (INSET)

K2

DANGER AND DESIRE ON THE SAVAGE MOUNTAIN





A rare view of the epic ridge on the Chinese side of K2—so remote and difficult that most climbers tackle the Karakoram Range peak from the Pakistani side. Here, members of the 2011 expedition ferry equipment to the base of the 28,251-foot summit.

GERLINDE KALTENBRUNNER DIDN'T CLIMB K2 BECAUSE SHE WANTED TO BE THE FIRST WOMAN TO SUMMIT ALL 14 8,000-METER PEAKS WITHOUT OXYGEN. BUT THAT'S EXACTLY WHAT SHE DID.

Buffeted by stinging blasts of wind-driven snow, Kaltenbrunner checks the ropes the team has spent weeks fixing along the entire route—9,000 feet of rope in all.

RALF DUJMOVITS







Kaltenbrunner grew up skiing in the mountains of her native Austria.

BENNO KRAEHAHN

BY CHIP BROWN

PHOTOGRAPHS
BY TOMMY HEINRICH

vsetlopat.net

Tomorrow Is Our Day

Here at last was a morning that gave them hope: Monday, August 22, Camp IV, 7,950 meters. The gales were gone, the snow had quit, the sky ran blue and cloudless to the black edge of space.

For most of July and half of August the six members of the International 2011 K2 North Pillar Expedition had been shuttling up and down the seldom attempted North Ridge of the world's second highest peak. Theirs was the only party on the remote Chinese side of K2, the Karakoram Range giant that rises 8,611 meters (28,251 feet) on the China-Pakistan border. The mountaineers were climbing the ridge (as it is commonly referred to, even though "ridge" understates the steepness of the terrain) without bottled oxygen or high-altitude porters.

What the team lacked in numbers it made up for in experience. The two climbers from Kazakhstan—Maxut Zhumayev, 34, and Vassiliy Pivtsov, 36—were making their sixth and seventh attempts to summit K2, respectively. Dariusz Załuski, a 52-year-old Polish videographer, was a veteran of three attempts. Tommy Heinrich, a 49-year-old photographer from Argentina, had two K2 expeditions on his résumé but had also failed to summit.

Most notable was Gerlinde Kaltenbrunner, a 40-year-old, dark-haired former nurse from Austria who was on her fourth trip to K2. If she succeeded this time, she would become the first woman in history to climb without supplemental oxygen all 14 of the world's peaks that exceed the mystique-endowed height of 8,000 meters (26,247 feet). She was leading the expedition with her husband, Ralf Dujmovits, 49, who had already climbed all of the 8,000-meter peaks (all but one without bottled oxygen) and was the foremost high-altitude mountaineer in Germany. He had reached the top of K2 from the Pakistani side on his first try, in July 1994.

It had taken 42 days for the six climbers to establish several camps connected by thousands of feet of rope fixed across a route that included everything from vertical rock and ice to avalanche-raked slopes of chest-deep snow. They pushed themselves to break trail in heavy snow, haul gear, shovel out campsites, pitch tents, melt ice. Many times they relinquished their gains on the mountain, going down to sleep at the lower elevation of Advanced Base Camp, at 4,650 meters on the K2 North Glacier.

On August 16 they set out on what would be their first and only real chance for the summit. The snow that had been falling for much of the summer had started again. They reached Camp I, at the foot of the ridge, that day; avalanches roared and more than a foot of snow fell overnight. They waited there for a day, hoping the snow on the slopes above would come down before they continued their ascent.

On August 18 at 5:10 a.m. they decided to push ahead to Camp II. Every extra ounce was a burden; to save weight, Gerlinde left her journal

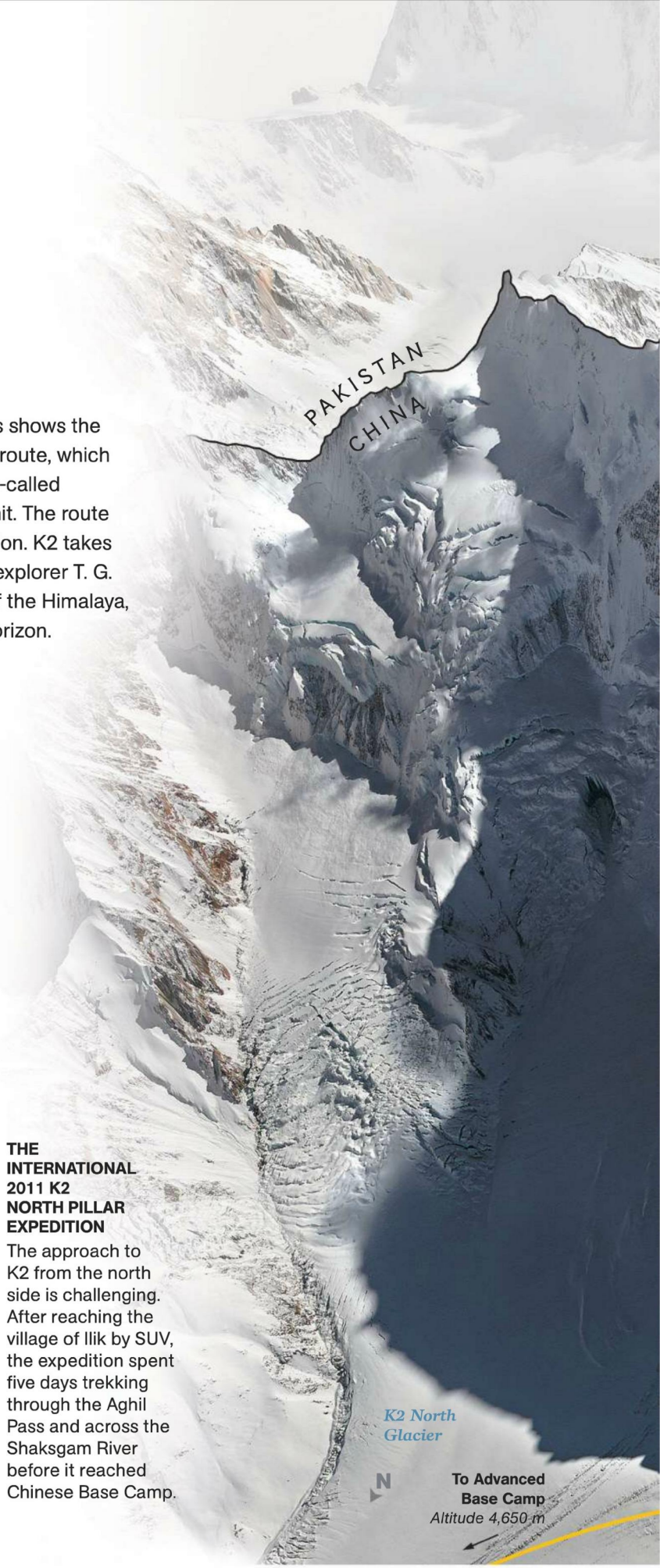
Chip Brown reported on the search for Cleopatra in the July 2011 issue. Tommy Heinrich photographed a Polish expedition to Nanga Parbat for the January 2008 issue.



K2 THE HARDEST WAY

An image created using satellite measurements shows the expedition's key camps along K2's North Ridge route, which follows the steep fin of rock and snow to the so-called Japanese Couloir, a gorge just below the summit. The route was first scaled in 1982, by a Japanese expedition. K2 takes its name from the 1856 survey notes of British explorer T. G. Montgomerie: "K" for Karakoram, a subrange of the Himalaya, and "2" for the second peak he noted on the horizon.





THE INTERNATIONAL 2011 K2 NORTH PILLAR EXPEDITION

The approach to K2 from the north side is challenging. After reaching the village of Ilik by SUV, the expedition spent five days trekking through the Aghil Pass and across the Shaksgam River before it reached Chinese Base Camp.

PEAKS OVER 8,000 METERS (26,247 ft)

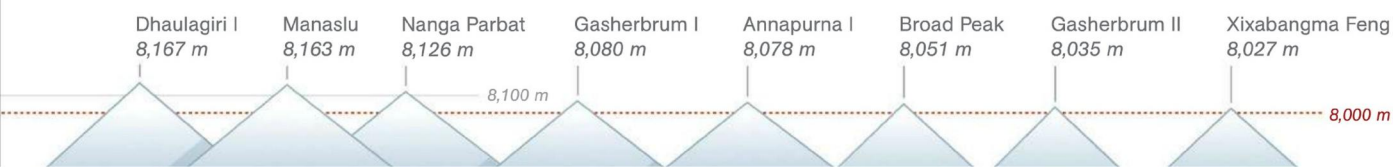




JUAN VELASCO AND MAGGIE SMITH, NGM STAFF

SOURCES: GERMAN AEROSPACE CENTER - DLR (IMAGE); DIGITAL GLOBE, EUROPEAN SPACE IMAGING (DATA)

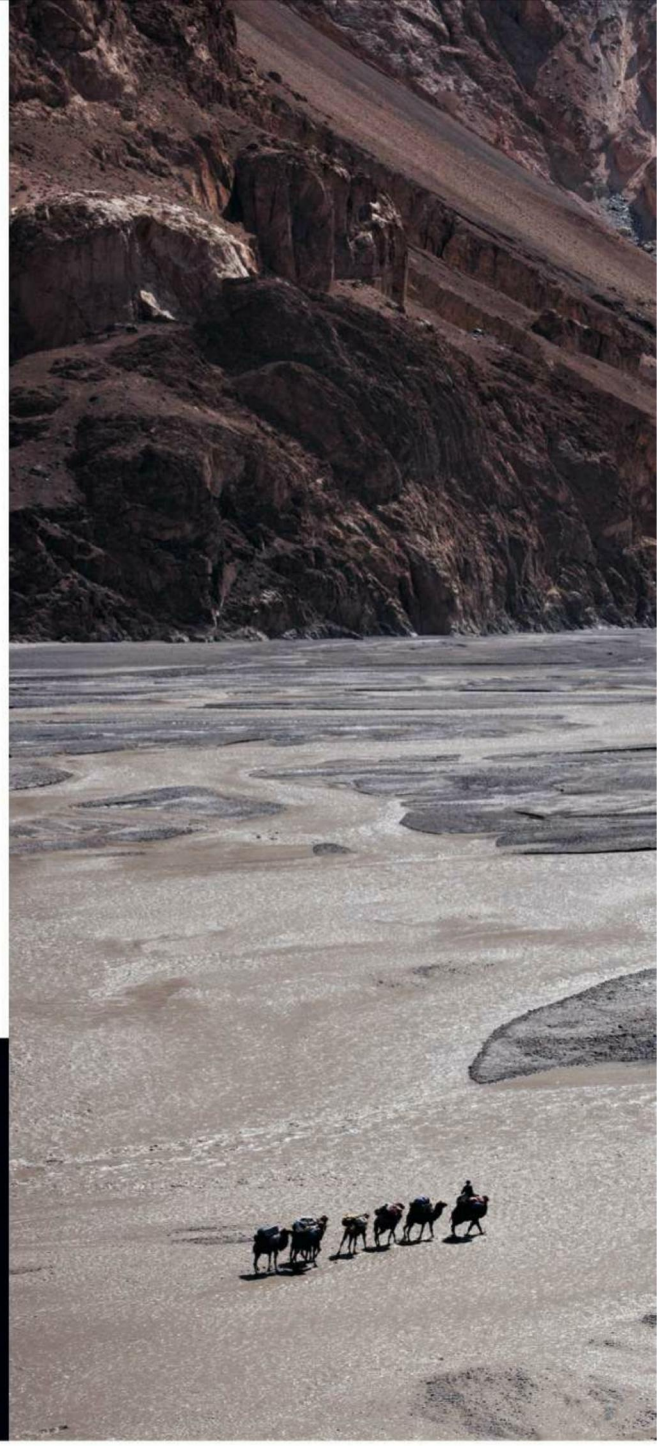
Commonly recognized peak names shown below



in the tent. Two avalanches had already swept over their route up a long gully. Around 6:30 a.m. Ralf stopped. So precarious were the snow conditions he could no longer ignore his gut feelings.

"Gerlinde, I am going back," he said.

Since the couple had been climbing together they had made a pact that neither would stand in the other's way if one wanted to continue and the other did not. Barring injury or ill health, they were responsible for themselves. On Nepal's Lhotse in 2006—just one of several examples—Gerlinde had climbed on alone for 20 minutes after Ralf had been deterred by fresh snow over the blue ice of the summit couloir, before she too turned back. She was, as he acknowledged, still brimming with *wagnis*—a German word meaning "daring." Having never been to the top of K2, she was willing to take risks that Ralf, who had, was not. She coped with fear differently too. Where he relished how the sensation of fear in his stomach revealed the margins of his ability and compelled him to pay attention, Gerlinde strove to block out fear with the quiet calm that possessed her when she was absorbed in what she had to do. If she kept herself completely focused on the task at hand, she didn't feel afraid.



It took dozens of camels and eight Kyrgyz drivers to haul 2.2 tons of gear across the bed of the Shaksgam River to Chinese Base Camp. The cost: $17,000—plus eight pairs of sunglasses.

But now, in the gully above Camp I, despite their agreement, despite knowing the delay might cost her a chance to reach the summit, Ralf begged his wife to come down with him. His composure deserted him. "Ralf was yelling that the route is very, very avalanche prone. He was shouting desperately," Maxut said later in a video on his website, "and Gerlinde shouted in return that now is the moment when the fate of the climb will be decided. If we turn around today, on the 18th, we are not making the period of good weather."

"I was really afraid I would never see her again," Ralf explained later.

In what was her most anguished moment of the climb so far, Gerlinde watched as Ralf

JUST GETTING TO K2 FROM THE

distributed his group gear to the rest of the team and descended into the mist. And then, in what may be the premier example of her tenacity and will, she returned to the task at hand. "It's not that I was indifferent to the risk," she said afterward. "But my gut feeling was good."

As Ralf had feared, the snow on the slope began to rip loose, three small slides in succession set off by Maxut, Vassiliy, and Gerlinde, who were out front breaking trail. The biggest hit Tommy, climbing almost 200 feet below; it knocked him upside down and stuffed his nose and mouth. Only the fixed rope, taut as a cello string, kept him from being flushed off



SILK ROAD CITY OF KASHI IS AN ARDUOUS JOURNEY.

the mountain. He was able to dig himself out, but the slide had refilled the broken trail, and eventually he too turned back.

So now they were four: Gerlinde, Vassiliy, Maxut, and Dariusz. The job of breaking trail was Sisyphean—worse really, because they couldn't pretend they hadn't volunteered for the punishment. Sweep the snow aside, crack the crust with your knee, compact what's underneath, step up, slip back. Repeat and repeat and repeat. After 11 hours they set up a bivouac at Shoulder Depot Camp, below Camp II, and spent a miserable night crammed into a two-person tent. The following day they negotiated the most difficult sections of the ridge and reached Camp II, at 6,600 meters, where they changed into down suits. On Saturday, August 20, they slogged on to Camp III, arriving in the afternoon, exhausted, chilled to the bone. They drank coffee with honey and warmed their hands and feet over their gas stoves. All night the hoarfrosted tent walls snapped and shuddered in the wind.

They had been promised better weather by a satellite-phone forecast Ralf passed along over the radio from Advanced Base Camp. The break finally arrived on Sunday, August 21, lifting everyone's spirits and helping to carry the team to Camp IV. They were now at nearly 8,000





The swift current nearly swallows a two-hump Bactrian camel crossing the frigid stream that drains multiple glaciers in the Sarpo Laggo Valley of the Karakoram Range. The channel was the last but most difficult water barrier before arriving at Chinese Base Camp.

meters, in the so-called death zone, where the body is unable to acclimatize to the oxygen-depleted air, cognition becomes impaired, and the simplest tasks can take forever. They spent the afternoon sharpening their crampons and melting snow. Toward evening they stood outside their tents, pitched in a notch of rock above an appalling void that plunged nearly two miles to the glacier below. Two thousand feet above lay the glistening white mantle of the summit, untouched since 2008, when 11 climbers died in one of the deadliest mountaineering episodes in the history of K2.

"There was a moment when we all started to get nervous, in a good way," Gerlinde said later. "We touched each other's hands and looked at each other in the eyes and said, 'OK, tomorrow is our day.'"

A Passion for Climbing

K2 has a singular place in high-altitude mountaineering. Though 784 feet lower than Mount Everest, it has long been known as the mountaineer's mountain. The sharp triangle of its silhouette and height above the surrounding terrain not only define the archetypal image of a mountain but, as a practical matter, also make K2 far more difficult and dangerous to climb. As of 2010 Everest had been summited 5,104 times; K2, just 302. Roughly one K2 climber has died for every four who've succeeded. After the first attempts by British and Italian climbing teams in the early 1900s, American parties tackled K2 in 1938, 1939, and 1953. Charles Houston and Robert Bates titled their account of their 1953 expedition *K2: The Savage Mountain.* The characterization has been invoked so often over the years you'd think the moods of K2 reflected some personal antipathy toward mountaineers petitioning for its favor rather than the random dynamics of the physical world. In 1954 K2 was finally "conquered" by a large Italian expedition that put two men on the top via the now standard summit route on the Pakistani side of the mountain.

As for Gerlinde Kaltenbrunner, the mountaineer's mountain had made an indelible impression on her when she first glimpsed it from nearby Broad Peak in 1994 at age 23. "I was fascinated by its shape," she said, "but I didn't dare imagine myself ever climbing on it."

Gerlinde, the fifth of six children, grew up in a Roman Catholic family in Spital am Pyhrn, a mountain village of about 2,200 people in central Austria. Her father, Manfred, worked in the local quarries; her mother, Rosamaria, was a cook in a youth hostel. Gerlinde idolized her big sister, Brigitte, ten years her senior. She was mad for sports: swimming, biking, skiing. There wasn't much money in the house; Gerlinde didn't see a movie in the cinema until she was 17.

She attended a school for sports, including ski training, where she discovered she was a good skier but not topflight. More upsetting was when supposedly close friends expressed resentment if she happened to do better in a race. The experience of early school rivalries soured her on competition and shaped her later reluctance to view herself as a contestant vying for records against other female mountaineers.

It was at church, not school, that her passion for climbing was awakened. In a country where most major mountains have crosses on top, it shouldn't be surprising that Erich Tischler, the local Catholic priest, wore climbing knickers under his cassock and, if the weather was good, would shorten his Sunday sermon to hasten his flock to the hills. Gerlinde served as an altar girl, attending Mass with her boots in her rucksack. Father Tischler led her on her first hike, at age seven, and on her first technical roped ascent, of Sturzhahn Mountain when she was 13.

After her parents' marriage ended in divorce in 1985, her relationship with her mother was strained. Gerlinde, then 14, moved out. She lived with her sister Brigitte and eventually followed her into the nursing profession. By 20 Gerlinde

GERLINDE STROVE TO BLOCK OUT FEAR BY STAYING COMPLETELY

had a job at a hospital in Rottenmann, a small town about 15 miles from Spital am Pyhrn. She was happy, near her family, but independent. On weekends she skipped off to the local alps to climb. The appetite for adventure, which had always set her apart from her family, led her to the Karakoram Range in 1994. On Broad Peak in Pakistan she abandoned her bid for the summit as the weather worsened, then changed her mind, and finally reached the forepeak, some 20 meters lower than the 8,051-meter summit, which lay at the far end of a long ridge. (She would return to summit in 2007.) She was elated but, having seen the body of a climber who'd died on the mountain, was also perplexed. "It cannot be that happiness, joy, and death are so closely linked together," she wrote in her journal.

Back home, Gerlinde saved money and cobbled together vacation days for trekking and climbing trips to Pakistan, China, Nepal, Peru. After her first expedition her father said, "OK, one is enough. You don't have to do any more." After the second he said, "Now you have two. That's enough."

"His wish was to see me get married and have a family," Gerlinde recalls. But she had known in her early 20s that children were not in her cards. She showed her father pictures and tried to explain the infusion of energy and happiness she felt in the mountains. There were risks of course, but nursing had taught her that death was part of life. And for perspective, she had only to look at the losses faced by Brigitte, who had already buried three husbands. Bad things could happen anytime, anywhere.

FOCUSED ON THE TASK AT HAND.

In 1998 Gerlinde climbed Cho Oyu, near the Nepal-China border, her first true 8,000-meter summit. Four years later, in 2002, she reached her third 8,000-meter summit, the top of 8,163-meter Manaslu in Nepal. In base camp she met Ralf Dujmovits, then 40 and at the peak of his celebrity, having starred in a live televised ascent of the north face of the Eiger in the Swiss Alps that was watched by millions of people. They got along like a pair of swans and broke trail together.

For more than 20 years women had been making inroads in the male domain of high-altitude mountaineering but were still frequently treated with condescension. In 2003, still acclimatized by an unsuccessful attempt on Kanchenjunga, Gerlinde flew to Pakistan to try the Diamir Face of the 8,126-meter Nanga Parbat. Above Camp II she found herself breaking trail in a single file with six male climbers from Kazakhstan and one from Spain. Her presence was not mentioned when the leader reported on the radio that seven climbers were heading up to Camp III. When she worked her way to the front of the line to take her turn breaking trail, she was nudged aside. Misguided chivalry? Arrogant disdain for her abilities? She wasn't sure but went politely to the back of the line. When she had worked her way to the front again and one of the male climbers tried to wave her away a second time, she'd had enough. She took off, bulldozing her way up the unbroken slope without stopping. She plowed the path all the way to Camp III. The gob-smacked climbers in her wake nicknamed her "Cinderella Caterpillar" for the trail-breaking machine that had appeared in their midst.

She was the first Austrian woman to summit Nanga Parbat, the mountain known for the first ascent by the legendary Austrian climber Hermann Buhl in 1953. Her success on the 50th anniversary of Buhl's audacious feat attracted notice in climbing magazines and gave her the impetus to make a profession out of her passion. Over the next two years she added Annapurna I, Gasherbrum I, Gasherbrum II, and Xixabangma Feng to her résumé. She now had climbed 8 of the 14 highest peaks. In January 2006 the German magazine *Der Spiegel* dubbed her "queen of the death zone." The image of a haughty monarch reigning over life and death had little to do with the actual character of a sensitive, unselfish woman (in base camp on K2 Gerlinde tried to see if a pair of sunglasses would relieve the distress of a snow-blind sheep), but



Bundled in their down suits, Ralf Dujmovits and Kaltenbrunner study the route up toward Camp IV and the beginning of the “death zone.” That is the point, above 8,000 meters, at which mountaineers who opt to climb without bottled oxygen face the limits of the human body. “What makes a difference in not having oxygen is your ability to fend off cold,” Dujmovits says. “You freeze yourself from the inside out, because you can’t burn enough fat to stay warm.”


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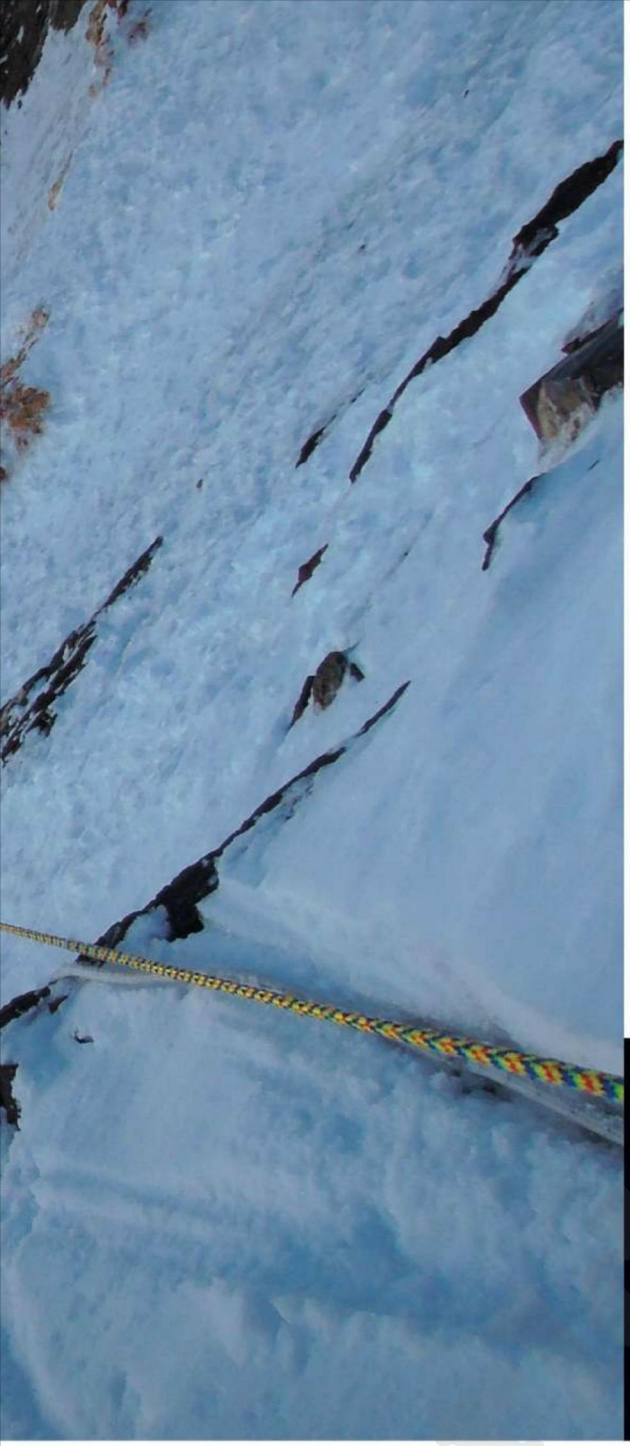


ROUGHLY ONE CLIMBER HAS DIED FOR EVERY FOUR WHO'VE SUCCEEDED

it did wonders for her lectures ticket sales, impressed sponsors, and secured her career as a professional mountaineer.

That spring of 2006, after she too had turned back on Lhotse, she found Ralf waiting in their camp at 7,250 meters. It was an unusually warm night; as they lay in their sleeping bags outside the tent under the stars with a bed of clouds blanketing the earth below and bolts of distant lightning blazing on the face of Everest, Ralf asked Gerlinde to marry him.

"It was not your typical first three months of marriage," Gerlinde says. The newlyweds spent the summer attempting various summits, together and separately. In May 2007, while Ralf guided an expedition to Manaslu, Gerlinde arranged to climb 8,167-meter Dhaulagiri I. She carefully placed her tent well left of the area where an avalanche had broken the neck of the famous female French mountaineer Chantal Mauduit in 1998. Close by were a pair of tents occupied by three Spanish climbers, who had invited Gerlinde in for coffee. At 9 a.m. on May 13, waiting for the winds to subside so she could start for Camp III, Gerlinde was lying in her tent, fully dressed except for her boots. There was a roar, and then a massive rush of snow devoured the camp, bowling her tent a hundred



With crampons, ice axes, and ropes they previously fixed, the climbers traverse west on the edge of the North Ridge. The route proved much steeper than they had anticipated.

IN MAKING THE SUMMIT OF K2.

feet down the slope to the edge of a precipice.

"I couldn't tell if I was up or down," she says. "My feet were completely packed in, but I could move my arms a little bit. I tried to get to the little knife I keep on my harness. I was worried the snow would smother me. I was able to cut through the wall of the tent with my knife. There was about 30 centimeters [a foot] of loose snow on top of it, and I punched my hand out. After about an hour I was able to get out of the tent. I had no shoes, no sunglasses."

She looked for the tents of her Spanish friends. One climber's solo tent was still intact, the other, with two climbers, was gone. Frantically she began to dig. An hour later, six feet down, she found it: Santiago Sagaste and Ricardo Valencia were inside, dead. All desire to do anything on Dhaulagiri but get down was gone. Later she poured out her feelings to Ralf. Why didn't she notice that the weather had turned ominously warm? Why did she ignore the sign when the turquoise bracelet that was her good luck charm broke the day before?

Despite the brush with oblivion, she returned to Dhaulagiri the next year and summited it.

To the Savage Mountain

Just getting to K2 is an arduous journey in its own right, though far easier than it was when the first expeditions traveled for months to reach the peak. I had arranged to accompany the 2011 team to Advanced Base Camp. We all met in the ancient Silk Road city of Kashi, or Kashgar, in the far west of China, and then headed south on June 19 in three Toyota Land Cruisers followed by a truck overloaded with more than two tons of equipment in blue plastic barrels: tents, sleeping bags, stoves, parkas, ice screws, solar panels, batteries, computers, 9,000 feet of rope, 525 eggs, packages of freeze-dried pasta primavera, a bottle of Chivas Regal, a DVD of the movie *Hall Pass.*

The road skirted the western edge of the Taklimakan Desert and passed through farming towns lined with silver poplars and orchards irrigated by the brawny rivers draining the Kunlun Mountains to the south and the Pamirs to the west. After a night in the dimly lit Yecheng Electricity Hotel we drove over the Chiragsaldi Pass and crept through billows of dust at ten miles an hour until we reached a desolate truck stop called Mazar. In the morning we turned west onto the ragged road that follows the Yarkant River all the way to the Kyrgyz nomad village of Ilik, population 250. We unrolled our sleeping bags in the rug-lined living room of a mud-brick house that belonged to the local

RALF DUJMOVITS

mullah. Most of the village turned out in the morning to help lash the expedition's gear to a herd of camels, and by midday the caravan was heading into the valley of the Surukwat River: 40 camels, eight donkeys, six cows, a small flock of sheep slated for Kyrgyz cooking pots, a Uygur liaison officer named Iskander Abibullah, and six mountaineers in high-tech fabrics and "day for night" sunglasses.

Gerlinde and Ralf were thrilled to be approaching K2 from the north for the first time. The first night in camp Ralf brought out a composite portrait of the mountain made using satellite mapping data and photographs. Maxut studied the daunting details of the North Ridge, which had been first climbed by a Japanese party in 1982; he and Vassiliy had spent many weeks on the ridge in 2007, before bad weather and shortages of food and water forced them to retreat.

"Too soon you show us these," Maxut said, only half joking. "Hard to sleep now. Where is vodka?"

On the third day we crossed Aghil Pass, at 4,780 meters, and descended into the valley of the Shaksgam River, which rises from the glaciers below the Gasherbrum peaks. Giant terraces of mud-packed rock framed a broad, gray stone plain braided with half a dozen or more channels of silty water. The channels didn't look too hard to cross, until you saw one of the mountain donkeys knocked off all four feet and whisked downstream like a plastic soda bottle. We crossed on the camels.

On the fifth morning, after an hour of walking, everyone suddenly stopped and stared up at the cloudless sky to the south as if flabbergasted by a UFO. There it was: K2, a colossus erupting out of the earth, its ice-draped walls shimmering in the morning sun like a mirage. It seemed unreal, and yet even from miles off its power was palpable. It was easy to understand the allure it held for mountaineers, no matter that its beauty was imbued with death and its frozen flanks were full of bones and buried bodies. And just as easy to understand why armchair mountaineers might shrink from the thing in dread, and wonder about the balance of reason and desire in those determined to climb it.

Gerlinde, who'd seen K2 many times from the south, sat down on a rock and gazed at the peak with what seemed a welter of emotion in her eyes.

Not wanting to intrude, I asked many weeks later what she'd been thinking about.

"I was thinking, What can I expect this time? How will it be?"

Her K2 history was shadowed with hard memories. She had made three expeditions to the southern side—the last in 2010. On the trip, after a rockfall above Camp III turned Ralf back, Gerlinde joined forces with a close friend of theirs, Fredrik Ericsson, an extreme skier who was attempting ski descents of the world's highest peaks. Carrying his skis in his pack, Fredrik set out with Gerlinde for the summit from Camp IV. At the base of the steep gully known as the Bottleneck he stopped to set a piton, and as he was hammering it, he lost his footing. He plunged past Gerlinde in an instant and was gone.

In shock, she climbed down as far as she could but found only a ski before the slope vanished into the misty void. Fredrik's body was later spotted in the snow 3,000 feet below the Bottleneck. He was 35.

As had been the case with the tragedy on Dhaulagiri, Gerlinde wanted nothing to do with K2 after Fredrik's death. Numb, sad, disillusioned with the price of the life she'd chosen, she went home. At the end of the year she and Ralf took a vacation in Thailand. For four weeks they lived by the sea. They ate fresh fish. They climbed on sea cliffs where falls ended in warm, green water.

People had always asked her why she kept going back to K2. For a long time she didn't have an answer. But gradually she began to think it wasn't the mountain's fault that Fredrik had died. The loss was savage but not the mountain. "The mountain is the mountain, and we are the people who go there," she says. Friends took a picture of beach stones arranged in the shape of a heart

Kaltenbrunner's self-portrait, with Dujmovits behind her, shows the strain of grueling conditions. It was difficult to relax even on the flat terrain leading to Camp I, because the K2 North Glacier is mined with hidden crevasses. Heavy summer snow made everything harder—from breaking trail and staying dry to digging out tents after storms.

GERLINDE KALTENBRUNNER (BELOW)





Standing on the front points of her crampons, Kaltenbrunner climbs the steep rock-and-snow pitches up to Camp II. As part of extensive training before expeditions, she refines her balance by walking on a rope stretched between two apple trees.

around a message they'd written with pebbles:

Gerlinde + Ralf

K2 2011

She used a print of it for the cover of her packing list.

One With the Universe

Around 7 a.m., Monday, August 22, Gerlinde, Vassiliy, Maxut, and Dariusz set out from Camp IV for a place that was as much the culmination of a common dream as a crowning point of Earth. It was a cloudless day, the weather like a gift. They were climbing up a steep chute of ice, the so-called Japanese Couloir, the predominant feature high on the mountain's north face. But with only a third of the oxygen at sea level, snow up to their chests in places, and stinging blasts of spindrift that forced them to stop and avert their faces, they made painfully slow progress. By 1 p.m. they had gained less than 180 meters.

Although they'd spent time above Camp IV in 2007, Vassiliy and Maxut were unfamiliar with the Japanese Couloir, and the way up was difficult to see. Gerlinde reached Ralf on the radio at Advanced Base Camp. Since turning back above Camp I, he had devoted himself to supporting the summit party, passing on weather forecasts, advice, and encouragement. Though miles away, he could see that the best place to cross the couloir was below the lip of a long, thin crevasse that ran the width of the slope, where the snow tended to be not as deep and the natural fracture in the slope would lessen the chance of the climbers triggering an avalanche. He helped guide them to the crevasse and watched as their figures, no bigger than commas on a page of paper, began edging across the couloir under a series of seracs—bulges of ice that protruded from the 45-degree slope like dormers from a roof. The seracs might protect them if avalanches swept down from above.

Nearing the rocky left edge, they turned to ascend directly up the slope until they came to a final serac at around 8,300 meters. They'd been climbing for 12 hours; they were 300 meters below the summit.

On the radio Ralf urged Gerlinde to return to Camp IV for the night now that they had broken the trail and knew the way.

"You cannot sleep there, you cannot relax," he said.

"Ralf," said Gerlinde, "we are here. We don't want to go back."

They had known when they set out that morning that their only chance for the summit might require a bivouac. The possibility had prompted Gerlinde to add the extra weight of a three-pound, two-person tent to her rucksack, as well as a pot and stove, and the same tacit understanding had prompted Dariusz, Maxut, and Vassiliy to tuck extra stove-gas canisters and food into their rucksacks. Days later Maxut tried to explain their state of mind to Tommy. "This was the limit," he said, tracing a line on the ground with his boot, "and this was how far we went beyond it." He put his boot half a yard beyond the line. "We completely passed the limit. I risked everything, even my family, my wife, my son, my daughter, everything."

With the sun low in the west, they stopped in the lee of the last serac to prepare a site for the tiny tent. For an hour and 20 minutes they hacked at the ice, until they had a level platform four feet wide, five feet long. They anchored the tent with two ice screws and a pair of ice axes. By 8:15 they were all inside, sitting on their rucksacks, a stove hanging from the ceiling with a pot of melting snow. Gerlinde made some tomato soup. The temperature was minus 13 Fahrenheit. The plan was to rest until midnight, then resume the push for the prize, now so close.

At one in the morning Vassiliy, Maxut, and Gerlinde strapped on their crampons and by the light of their headlamps started up the steep grade above the tent. Dariusz was still inside getting ready. Gerlinde swung her arms in big circles, but she couldn't feel her fingers, and she was having trouble unclipping from the rope. Maxut's feet felt like blocks of ice. They retreated to the tent to try to get warm and wait for sunrise. Gerlinde shivered uncontrollably. It was hard to believe that eight weeks earlier they had all been sweltering in 100-degree temperatures in the Shaksgam



On this day the weather is windy but improving. The fixed ropes buried under new snow, Kaltenbrunner presses on up to Camp III between fellow climbers Vassiliy Pivtsov and Dariusz Załuski. “Many times I felt as if I were being carried along,” she says. “It was mystical—I was getting power from somewhere. It has happened to me a few times before, but the feeling was never so strong as on K2.”

MAXUT ZHUMAYEV







GERLINDE KALTENBRUNNER (TOP); DARIUSZ ZAŁUSKI (ABOVE)

After Kaltenbrunner reached the summit first, Maxut Zhumayev and Pivtsov, bent with exhaustion, trudge the final steps shoulder to shoulder. The climbers celebrate as Załuski, the videographer, captures the moment. At right, reunited after separating on the mountain, Kaltenbrunner and Dujmovits embrace at the depot above Advanced Base Camp. “The joy and relief that I felt when Ralf took me into his arms are almost impossible to describe,” Kaltenbrunner wrote on her website, which got 17 million hits on the day of the summit push. “My life’s dream has come true.”




deuter

Valley, and Maxut had been rubbing yogurt on his sunburned legs.

They set out again around 7 a.m. as another immaculate morning dawned. It was now or never. In her rucksack Gerlinde had spare batteries, extra mittens, toilet paper, a second pair of sunglasses, bandages, drops for snow blindness, cortisone, a syringe; for her main sponsor she also carried a flag with the name of an Austrian oil company. For herself, she had a tiny copper box containing a figure of the Buddha, which she planned to bury on the summit. Inside her suit she tucked the half liter of water she had managed to melt; in her pack it would freeze.

They worked their way up the slope toward a 130-meter ramp of snow that angled up to the summit ridge. They were still suffering from the cold but by 11 a.m. could see they would soon be in the sun. At 3 p.m. they reached the base of the ramp. For the first 20 meters they were exhilarated to discover they sank only to their shins. But soon the snow was chest deep. Where they had switched leads to break trail every 50 steps, they now had to switch every 10, with Maxut and Vassiliy taking extra turns. Oh my God, Gerlinde thought, it's not possible that we've come so far up and will have to turn back.

Desperate for an easier way, they stopped climbing in single file at one point. From below, Ralf was astonished to see their track split into three lines as Gerlinde, Vassiliy, and Maxut searched for better footing. Ahead lay a band of snow-patched rocks tilted at 60 degrees. Steep as it was, it proved easier to negotiate. Climbing single file again, Gerlinde changed places with Vassiliy and sank only up to her knees. With a surge of energy and hope she clambered out of the ramp and onto the ridge, where the wind-packed snow was like a sidewalk. It was 4:35 p.m. She could see the summit dome.

"You can make it!" Ralf cried over the radio. "You can make it! But you are late! Take care!"

She sipped from her water bottle. Her throat was cracked; it hurt to swallow. It was too cold to sweat, but they were all getting dehydrated just from panting for air.

When Vassiliy caught up, he said she should go on to the summit, he would wait for Maxut. Like Gerlinde, he and Maxut stood on the brink of the only 8,000-meter summit they hadn't climbed. He wanted to go to the top beside his partner but didn't want people to think he couldn't have gotten there as quickly as Gerlinde. "You have to say I waited for Maxut," he told her.

"Yes, of course," she said.

And then she walked the final steps to the apex of K2.

It was 6:18 p.m. She wanted to share the moment with Ralf, but when she opened the radio she couldn't speak. There were mountains in every direction. Mountains she had climbed. Mountains that had stolen the lives of her friends and nearly claimed hers too. But never had she invested so much in a mountain as the one under her boots at last. Alone, with the world at her feet, she turned from one point of the compass to another.

"It was one of the most powerful experiences of my life," she said later. "I felt as if I were one with the universe. It was so strange on one hand to be extremely exhausted and on the other to be getting so much energy from the view."

Fifteen minutes later Maxut and Vassiliy arrived, shoulder to shoulder. Everyone embraced. Half an hour later Dariusz staggered up, his hands suffering from having taken his gloves off to change batteries on the video camera. It was 7 p.m. Their shadows reached far across the top of K2, as the pyramidal shadow of the mountain itself reached for miles to the east, and a beautiful golden light began to burnish the world. Dariusz filmed as Gerlinde tried to articulate what

OH MY GOD, GERLINDE THOUGHT, IT'S NOT POSSIBLE WE'VE COME SO FAR

Society Grant The International 2011 K2 North Pillar Expedition was funded in part by your National Geographic Society membership.

it meant to her to be there at that moment: "I'm so deeply filled to stand here now after so many tries, so many years." She began to cry, then composed herself. "It was very, very hard, all the days now, and now it's just amazing. I don't find the right words." She gestured to the sea of peaks in all directions. "You see all this—I think everybody can understand why we do this."

Stand With Us

Ralf was up most of the night monitoring the descent. More than a third of all fatalities on K2 have happened on the way down. Around 8:30 p.m. he could see four tiny pinpricks of light moving down the ramp into the Japanese Couloir. As she descended in the dark, exhausted, Gerlinde found herself repeating a phrase that had been in her mind: *Steh uns bei und beschütze uns.* Stand with us and protect us.

"We spoke many times on the descent," said Gerlinde. "We asked each other again and again, 'Is everything OK?' It was just a very serious, very exacting climb. If there would have been just the cold, it would have been hard enough. But there was the steepness, the altitude, the wind during the night and the morning, and the psychological effects—we didn't have any rope left to fix the route, and the terrain was very steep and exposed. Everybody had to take a very long time and be very careful how they moved."

UP AND WILL HAVE TO TURN BACK.

Two days later, when Gerlinde came down from Camp I, Ralf met her on the glacier. They held each other for a long time. At Camp I she had found the letter he had left for her in the hope that she would return—a four-foot-long missive written on toilet paper avowing his love and explaining his decision to turn back. "I don't always want to be the person who holds you back…"

In base camp Gerlinde spoke by satellite phone to Fredrik's father, Jan Olaf Ericsson, who wanted to know everything she had seen from the summit of the mountain where his son was buried. The president of Austria called to congratulate her. The prime minister of Kazakhstan congratulated Maxut and Vassiliy on Twitter. In the dining tent Gerlinde fell asleep over a plate of watermelon.

At the airport in Munich her whole family turned out to greet her. Her father cried when he hugged her, and for the first time he did not say she'd climbed enough mountains and should stop.

With hardly an ounce of fat to start with, she'd lost 17 pounds. At a ceremony in Bühl, Germany, Gerlinde was showered with bouquets and gifts, including a jeroboam of red Rhine wine labeled with a picture of her atop K2 with her arms over her head. "Normally you will not find me with my arms over my head," she says. "It's not that I felt like a queen, but that I wanted to hug the whole world."

Her friend and fellow climber David Göttler had arrived in Bühl from Munich to help edit the video of the climb for the lectures she would give. He tried several different pieces of music for the crucial summit scene, but none worked as well as "Ára bátur" by the Icelandic band Sigur Rós. He arranged the pictures and footage so the chorus of angelic voices and symphonic strings and horns all came to a crescendo just as Gerlinde thrust her arms overhead at the summit. He showed it to Ralf, who was thrilled by how powerfully it conveyed the glory of Gerlinde's triumph.

But when they showed it to Gerlinde, she frowned and shook her head.

"No, Ralf, it's too much. I'm sorry, David. I think it's too much."

They protested, to no avail. Then David, who had attempted K2 with Gerlinde in 2009 and knew her well, began to rework the scene. The pictures were the same. The music was the same. But the effect was completely different. The flow of photographs that ended with the climactic picture of Gerlinde's upraised arms had been altered so that the crescendo of the music did not proclaim the glory of one mountaineer that sundown hour on the summit of K2 but the great world she could see all around her, transfigured in golden light.

She smiled when she saw it. □

Workhorse Press



A tiny pinprick of light emanates from the tent of the successful summit team (on the peak at center left), signaling their return to the bivouac site at 8,300 meters after 15 hours of climbing. Photographer Tommy Heinrich's 14-minute exposure was made from Advanced Base Camp, more than two miles away.



TANGIBLE SPIRITS

In Africa and its diaspora the mask transforms mortals into gods and makes a political point.



PHOTOGRAPHS BY PHYLLIS GALEMBO





SIERRA LEONE On festival days in Freetown, social clubs parade in the streets, led by an ancestral "devil." This fierce and fancy water buffalo spirit is the figurehead for a men's group.





HAITI Not all masquerades require masks, or occur in Africa. In the Haitian port city of Jacmel three boys become Pa Wowo—painted, coconut-leaf-skirted peasants who personify poverty—for the spring carnival. When children participate, says art historian Jean Borgatti, “everyone loves it, because it means continuity.”



MASQUERADES CAN BE SACRED, HISTORICAL, OR SATIRICAL.

IN THE REALM of the spirit world, the mask is more than mere facade. It is utterly transformative. The man in the mask—and it is nearly always a man—may speak in a different voice, move differently, behave differently, because he is a different being. The mask is put on. The line between reality and illusion, god and man, life and death blurs. The masked man is not playing a role. He becomes the role.

The mask is the centerpiece of a costume, often with props, that the wearer carries during a masquerade, a ritual ceremony performed before a community. Some masquerades are entertainment—a parade, for example, or dance that reinforces the cultural identity of a community. Others remain embedded in religious or social ritual. In these performances the masquerader may serve as a kind of moral policeman: instructing, punishing, maintaining and restoring order, or presiding over a passage—boy to man, citizen to leader, planting to harvest.

The origins of masking are lost in the fog of ancient history, but they may reside, art historian Herbert M. Cole suggests, in hunting rituals: the desire to embody or perhaps appease the spirit of the prey.

For more than 20 years photographer Phyllis Galembo has traveled Africa and Haiti documenting the art of the masquerade. What is it about masks? "It's the creativity," says Galembo. "It's not just the mask. It's about the entire ensemble and the uniqueness of ritual dress." In making her images, Galembo travels to both cities and remote villages and, with the help of a guide, puts her ear to the ground in search of masquerade ceremonies. She sets up lights and tripod facing a wall, a fence, the side of a house, and allows her subjects to position themselves. She shoots one roll of 12 frames. That's it. "Either I have it, or I don't," she says. More often than not, she does. —*Cathy Newman*

In her book Maske *photographer and fine arts professor Phyllis Galembo features more than a hundred masks from Africa and the African diaspora.*





GHANA In the town of Winneba a cowboy is both protector and fashion plate. This one, from the year-end, century-old Fancy Dress Festival, wears a playful mix: bright holiday ornaments, zebra-striped cloth that conjures wildlife, and imported textiles that evoke African, European, and popular cultures.



BENIN This strange character, which appears at a yearly festival in Agonli that honors women, is known as You Can't Buy Wisdom at the Market. The mishmash garb may satirically make the point that enlightenment is never for sale, says scholar Babatunde Lawal—a message that is part of the sacred event.

SIERRA LEONE
Frills and ruffles lend a feminine air to this dancing joker, called a *jollay*, in a Fullahtown parade. Despite the girlish garb, the actor is a man. Like Greek theater, African masquerades reflect male-dominated societies. Women are often excluded because masks are said to link the wearer to a dangerous spirit world. "Just putting one on," says Borgatti, "is a charged event."









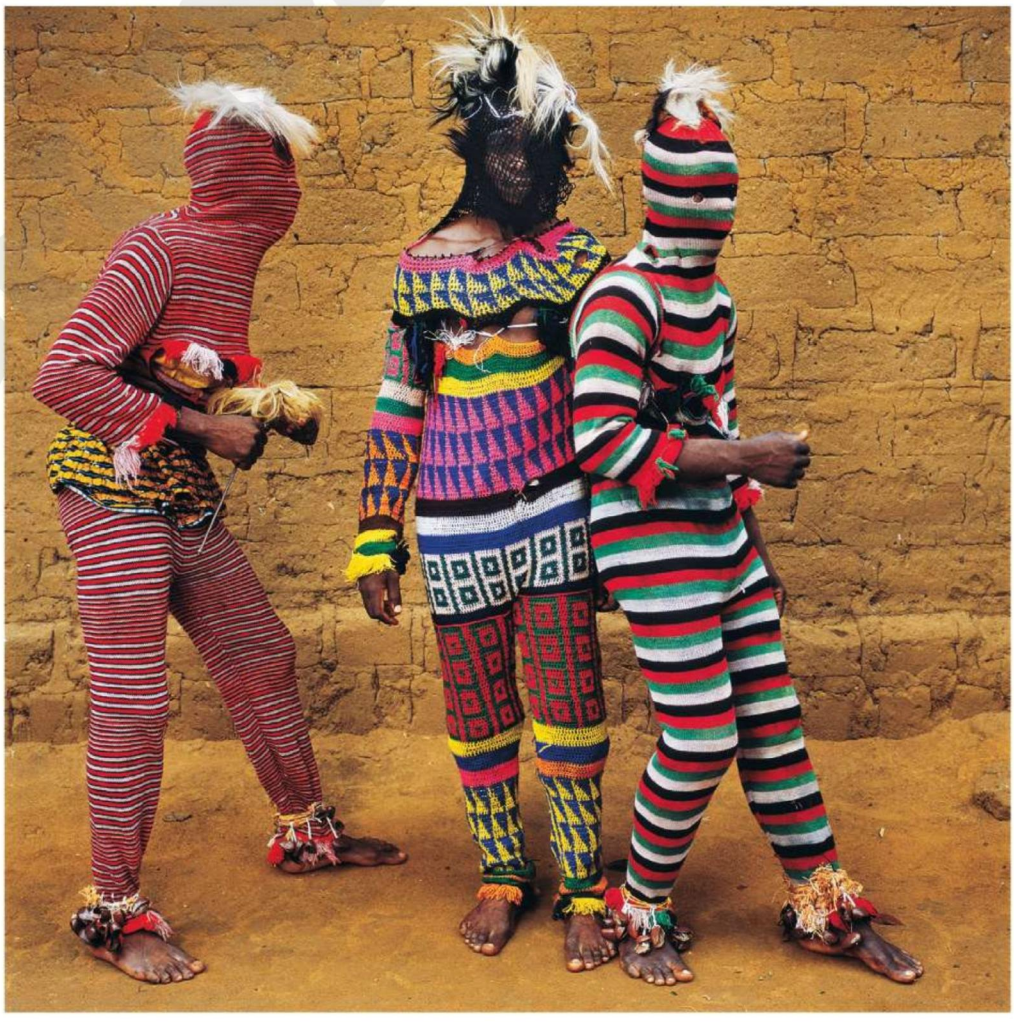


NIGERIA The diverse Cross River region is home to a host of masquerade traditions. In the village of Alok a carving of the female water spirit Mami Wata crowns a costumed man's headdress (top left). Mami Wata is controversial—linked to health and wealth in Africa and its diaspora, demonized by some Muslim and Christian fundamentalists. Other spirits represent nature or esteemed

SOME SPIRITS ARE SAID TO GUIDE AND JUDGE THE LIVING.



ancestors who guide, judge, or entertain the living. They're portrayed with forest greenery and netlike fabrics (bottom left, top right) during Christmastime in urban Calabar. In remote Eshinjok an acrobatic troupe (bottom right) dazzles eyes and ears with vibrantly dyed, hand-looped fibers and ankles bearing shells, bells, and bottle caps.







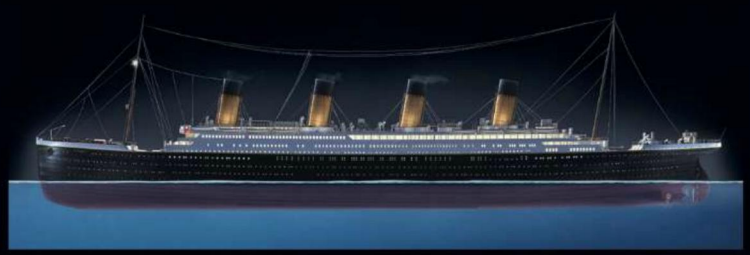
HAITI The tools of modern revolutions, a gun and a phone, are held by a masked youth. Other parts of his hellish carnival attire connect to Haiti's past. To symbolize the suffering of slaves, he's wrapped in a rope, his skin glazed in charcoal and molasses—an inexpensive, easy-to-make masquerade worn since colonial times.



SIERRA LEONE New materials and influences push artists to improvise. In Kroo Bay a hunting society's deer spirit flaunts a traditional carved-wood mask, store-bought gloves, and armor made of gourd slices sewn to a net. One scholar thinks the artist may have been inspired by chain mail seen in a Hollywood movie.

Unseen

At 2:20 a.m. on April 15, 1912, the "unsinkable" R.M.S. *Titanic* disappeared beneath the waves, taking with her 1,500 souls. One hundred years later, new technologies have revealed the most complete—and most intimate—images of the famous wreck.



The porthole at right is among more than 5,000 objects retrieved from the ocean floor around the wreck of the Titanic. *Steel hull plates flexed on impact with the seabed, popping out the rigid portholes.*

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Titanic

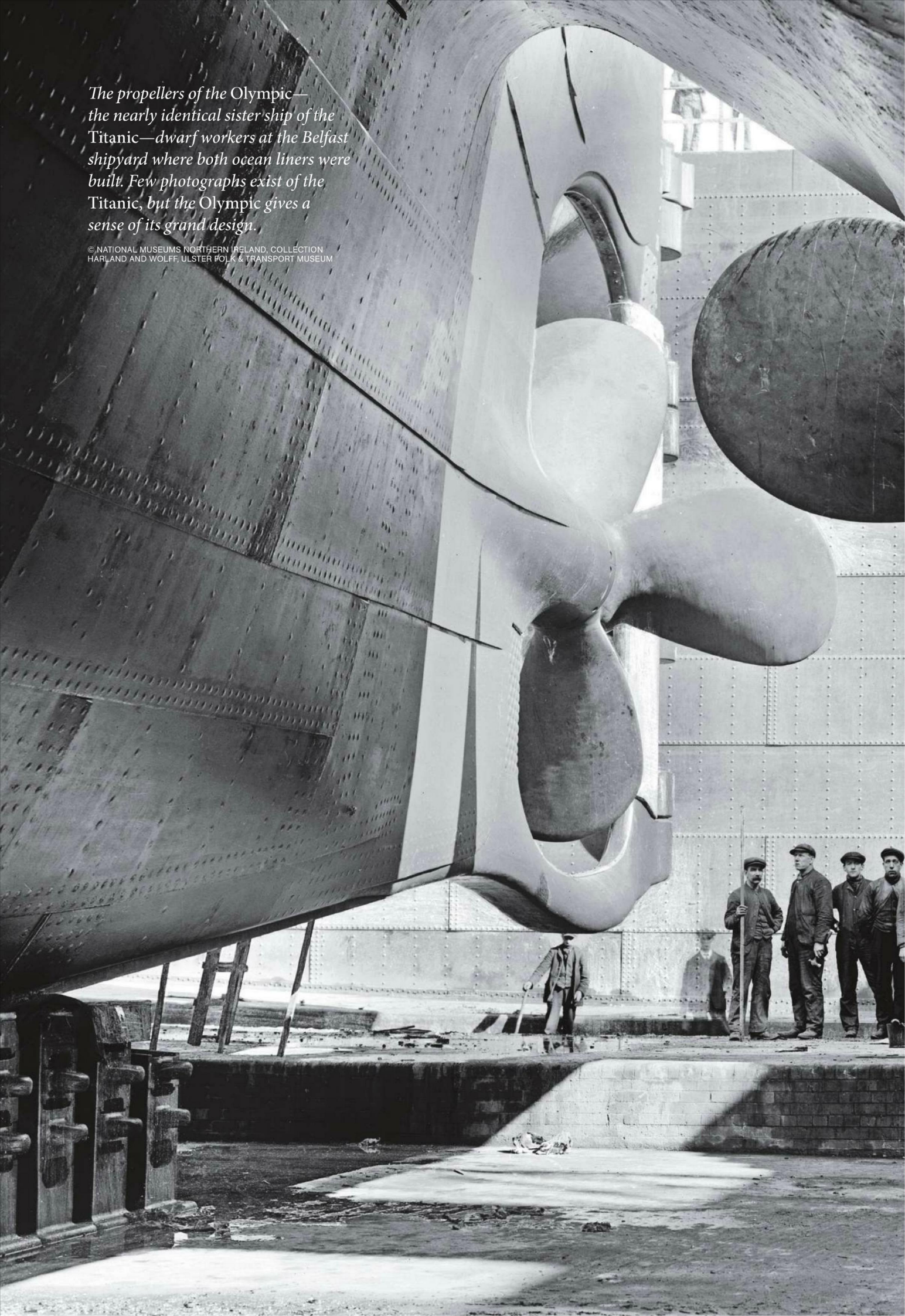




More than two miles down, the ghostly bow of the Titanic *emerges from the darkness on a dive by explorer and filmmaker James Cameron in 2001. The ship might have survived a head-on collision with an iceberg, but a sideswipe across her starboard side pierced too many of her watertight compartments.*

WALDEN MEDIA





The propellers of the Olympic*—the nearly identical sister ship of the* Titanic*—dwarf workers at the Belfast shipyard where both ocean liners were built. Few photographs exist of the* Titanic*, but the* Olympic *gives a sense of its grand design.*

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With her rudder cleaving the sand and two propeller blades peeking from the murk, Titanic*'s mangled stern rests on the abyssal plain, 1,970 feet south of the more photographed bow. This optical mosaic combines 300 high-resolution images taken on a 2010 expedition.*

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"The lights are finally on."

Revealed through new imagery, the greatest ship that ever sailed continues to hold and haunt our imaginations.

BY HAMPTON SIDES

A gentleman's pocket watch in a sterling silver case may have been set to New York time in anticipation of a safe arrival.



THE WRECK SLEEPS in darkness, a puzzlement of corroded steel strewn across a thousand acres of the North Atlantic seabed. Fungi feed on it. Weird colorless life-forms, unfazed by the crushing pressure, prowl its jagged ramparts. From time to time, beginning with the discovery of the wreck in 1985 by Explorer-in-Residence Robert Ballard and Jean-Louis Michel, a robot or a manned submersible has swept over *Titanic*'s gloomy facets, pinged a sonar beam in its direction, taken some images—and left.

In recent years explorers like James Cameron and Paul-Henry Nargeolet have brought back increasingly vivid pictures of the wreck. Yet we've mainly glimpsed the site as though through a keyhole, our view limited by the dreck suspended in the water and the ambit of a submersible's lights. Never have we been able to grasp the relationships between all the disparate pieces of wreckage. Never have we taken the full measure of what's down there.

Until now. In a tricked-out trailer on a back lot of the Woods Hole Oceanographic Institution (WHOI), William Lange stands over a blown-up sonar survey map of the *Titanic* site (see poster)—a meticulously stitched-together mosaic that has taken months to construct. At first look the ghostly image resembles the surface of the moon, with innumerable striations in the seabed, as well as craters caused by boulders dropped over millennia from melting icebergs.

On closer inspection, though, the site appears to be littered with man-made detritus—a Jackson Pollock-like scattering of lines and spheres, scraps and shards. Lange turns to his computer and points to a portion of the map that has been

brought to life by layering optical data onto the sonar image. He zooms in, and in, and in again. Now we can see the *Titanic*'s bow in gritty clarity, a gaping black hole where its forward funnel once sprouted, an ejected hatch cover resting in the mud a few hundred feet to the north. The image is rich in detail: In one frame we can even make out a white crab clawing at a railing.

Here, in the sweep of a computer mouse, is the entire wreck of the *Titanic*—every bollard, every davit, every boiler. What was once a largely indecipherable mess has become a high-resolution crash scene photograph, with clear patterns emerging from the murk. "Now we know where everything is," Lange says. "After a hundred years, the lights are finally on."

Bill Lange is the head of WHOI's Advanced Imaging and Visualization Laboratory, a kind of high-tech photographic studio of the deep. A few blocks from Woods Hole's picturesque harbor, on the southwestern elbow of Cape Cod, the laboratory is an acoustic-tiled cave crammed with high-definition television monitors and banks of humming computers. Lange was part of the original Ballard expedition that found the wreck, and he's been training ever more sophisticated cameras on the site ever since.

This imagery, the result of an ambitious multimillion-dollar expedition undertaken in August-September 2010, was captured by three state-of-the-art robotic vehicles that flew at various altitudes above the abyssal plain in long, preprogrammed swaths. Bristling with side-scan and multibeam sonar as well as high-definition optical cameras snapping hundreds of images a second, the robots systematically "mowed the lawn," as the technique is called, working back and forth across a three-by-five-mile target area of the ocean floor. These ribbons of data have now been digitally stitched together to assemble a massive high-definition picture in which everything has been precisely gridded and geo-referenced.

"This is a game-changer," says National Oceanic and Atmospheric Administration (NOAA) archaeologist James Delgado, the expedition's chief scientist. "In the past, trying to understand *Titanic* was like trying to understand Manhattan at midnight in a rainstorm—with a flashlight. Now we have a site that can be understood and measured, with definite things to tell us. In years to come this historic map may give voice to those people who were silenced, seemingly forever, when the cold water closed over them."

WHAT IS IT about the wreck of the R.M.S. *Titanic*? Why, a century later, do people still lavish so much brainpower and technological ingenuity upon this graveyard of metal more than two miles beneath the ocean surface? Why, like Pearl Harbor, ground zero, and only a few other hallowed disaster zones, does it exert such a magnetic pull on our imagination?

For some the sheer extravagance of *Titanic*'s demise lies at the heart of its attraction. This has always been a story of superlatives: A ship so strong and so grand, sinking in water so cold and so deep. For others the *Titanic*'s fascination begins and ends with the people on board. It took two hours and 40 minutes for the *Titanic* to sink, just long enough for 2,208 tragic-epic performances to unfold, with the ship's lights blazing. One coward is said to have made for the lifeboats dressed in women's clothing, but most people were honorable, many heroic. The captain stayed at the bridge, the band played on, the Marconi wireless radio operators continued sending their distress signals until the very end. The passengers, for the most part, kept to their Edwardian stations. How they lived their final moments is the stuff of universal interest, a danse macabre that never ends.

Hampton Sides, who wrote about explorer Fridtjof Nansen in the January 2009 issue, is at work on a book about the Arctic voyage of the U.S.S. Jeannette.

But something else, beyond human lives, went down with the *Titanic:* An illusion of orderliness, a faith in technological progress, a yearning for the future that, as Europe drifted toward full-scale war, was soon replaced by fears and dreads all too familiar to our modern world. "The *Titanic* disaster was the bursting of a bubble," James Cameron told me. "There was such a sense of bounty in the first decade of the 20th century. Elevators! Automobiles! Airplanes! Wireless radio! Everything seemed so wondrous, on an endless upward spiral. Then it all came crashing down."

THE MOTHER of all shipwrecks has many homes—literal, legal, and metaphorical—but none more surreal than the Las Vegas Strip. At the Luxor Hotel, in an upstairs entertainment court situated next to a striptease show and a production of *Menopause the Musical,* is a semipermanent exhibition of *Titanic* artifacts brought up from the ocean depths by RMS Titanic, Inc., the wreck's legal salvager since 1994. More than 25 million people have seen this exhibit and similar RMST shows that have been staged in 20 countries around the world.

I spent a day at the Luxor in mid-October, wandering among the *Titanic* relics: A chef's toque, a razor, lumps of coal, a set of perfectly preserved serving dishes, innumerable pairs of shoes, bottles of perfume, a leather gladstone bag, a champagne bottle with the cork still in it. They are mostly ordinary objects made extraordinary for the long, terrible journey that brought them to these clean Plexiglas cases.

I passed through a darkened chamber kept as cold as a meat locker, with a Freon-fed "iceberg" that visitors can go up to and touch. Piped-in sighs and groans of rending metal contributed to the sensation of being trapped in the belly of a

A hat of felted rabbit fur likely belonged to a businessman. In an era when dress defined the man, the bowler marked the professional class.



fatally wounded beast. The exhibit's centerpiece, however, was a gargantuan slab of *Titanic*'s hull, known as the "big piece," that weighs 15 tons and was, after several mishaps, hoisted by crane from the seabed in 1998. Studded with rivets, ribbed with steel, this monstrosity of black metal reminded me of a *T. rex* at a natural history museum: impossibly huge, pinned and braced at great expense—an extinct species hauled back from a lost world.

The RMST exhibit is well-done, but over the years many marine archaeologists have had harsh words for the company and its executives, calling them grave robbers, treasure hunters, carnival barkers—and worse. Robert Ballard, who has long argued that the wreck and all its contents should be preserved in situ, has been particularly caustic in his criticism of RMST's methodologies. "You don't go to the Louvre and stick your finger on the *Mona Lisa*," Ballard told me. "You don't visit Gettysburg with a shovel. These guys are driven by greed—just look at their sordid history."

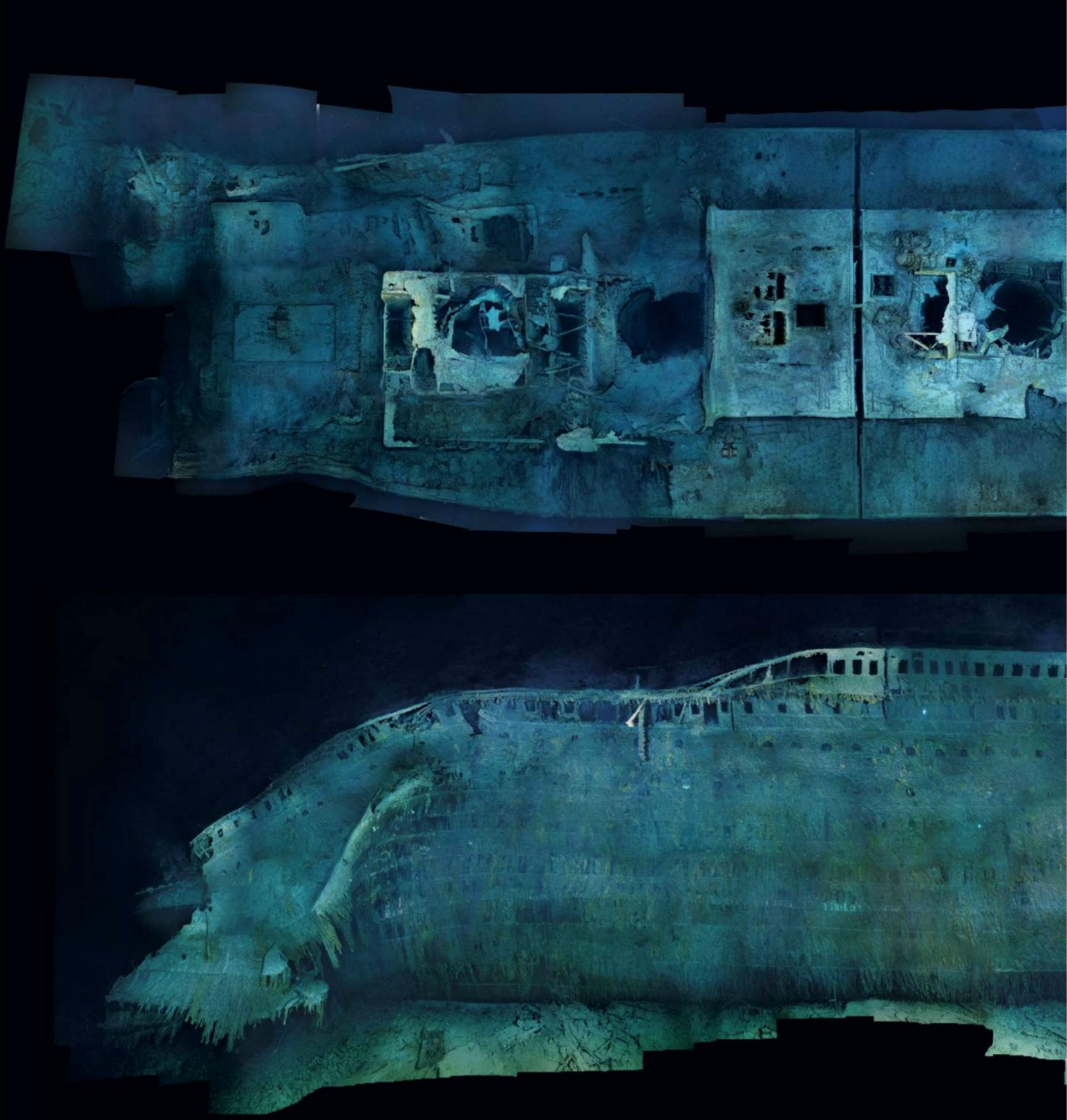
In recent years, however, RMST has come under new management and has taken a different course, shifting its focus away from pure salvage toward a long-term plan for approaching the wreck as an archaeological site—while working in concert with scientific and governmental organizations most concerned with the *Titanic*. In fact, the 2010 expedition that captured the first view of the entire wreck site was organized, led, and paid for by RMST. In a reversal from years past, the company now supports calls for legislation creating a protected *Titanic* maritime memorial. Late in 2011 RMST announced plans to auction off its entire $189 million collection of artifacts and related intellectual property in time for the disaster's hundredth anniversary—but only if it can find a bidder willing to abide by the stringent conditions imposed by a federal court, including that the collection be kept intact.

I met RMST's president, Chris Davino, at the company's artifacts warehouse, tucked next to a dog grooming parlor in a nondescript block on the edge of Atlanta's Buckhead district. Deep inside the climate-controlled brick building, a forklift trundled down the long aisles of industrial shelving stacked with meticulously labeled crates containing relics—dishes, clothing, letters, bottles, plumbing pieces, portholes—that were retrieved from the site over the past three decades. Here Davino, a dapper, Jersey shore-raised "turnaround professional" who has led RMST since 2009, explained the company's new tack. "For years, the only thing that all the voices in the *Titanic* community could agree on was their disdain of us," he said. "So it was time to reassess everything. We had to do something beyond artifact recovery. We had to stop fighting with the experts and start collaborating with them."

Which is exactly what's happened. Government agencies such as NOAA that were formerly embroiled in lawsuits against RMST and its parent company, Premier Exhibitions, Inc., are now working directly with RMST on various long-range scientific projects as part of a new consortium dedicated to protecting the wreck site. "It's not easy to thread the needle between preservation and profit," says Dave Conlin, chief marine archaeologist at the National Park Service, another agency that had been vehemently critical of the company. "RMST deserved the flak they got in years past, but they also deserve credit for taking this new leap of faith."

Scholars praise RMST for recently hiring one of the world's preeminent *Titanic* experts to analyze the 2010 images and begin to identify the many unsorted puzzle pieces on the ocean floor. Bill Sauder is a gnome-like man with thick glasses and a great shaggy beard that flexes and snags on itself when he laughs. His business card identifies him as a "director of *Titanic* research," but that doesn't begin to hint at his encyclopedic mastery of the *Titanic*'s class of ocean liners. (Sauder himself prefers to say that he is RMST's "keeper of odd knowledge.")

When I met him in Atlanta, he was parked at his computer, attempting to make head or tail of a heap of rubbish photographed in 2010 near the *Titanic*'s stern. Most *Titanic* expeditions have focused on the more photogenic bow section, which lies over a third of a mile to the north of most of the wreckage, but Sauder thinks that the area in the vicinity of the stern is where the



The first complete views of the legendary wreck

Ethereal views of Titanic*'s bow (modeled at right) offer a comprehensiveness of detail never seen before. The optical mosaics (above) each consist of 1,500 high-resolution images rectified using sonar data. As the starboard profile shows, the* Titanic *buckled as it plowed nose-first into the seabed, leaving the forward hull buried deep in mud—obscuring, possibly forever, the mortal wounds inflicted by the iceberg.*

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iPad Exclusive
Explore and zoom in on a 360º view of *Titanic*'s bow.



Titanic*'s battered stern, captured here in profile (above) and overhead, bears witness to the extreme trauma inflicted upon it as it corkscrewed to the bottom. Making sense of this tangle of metal presents endless challenges to experts. Says one: "If you're going to interpret this stuff, you gotta love Picasso."*

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real action will likely be concentrated in years to come—especially with the new RMST images providing a clearer guide. "The bow's very sexy, but we've been to it hundreds of times," Sauder said. "All this wreckage here to the south is what I'm interested in."

In essence Sauder was hunting for anything recognizable, any pattern amid the chaos around the stern. "We like to picture shipwrecks as Greek temples on a hill—you know, very picturesque," he told me. "But they're not. They're ruined industrial sites: piles of plates and rivets and stiffeners. If you're going to interpret this stuff, you gotta love Picasso."

Sauder zoomed in on the image at hand, and within a few minutes had solved at least a small part of the mystery near the stern: Lying atop the wreckage was the crumpled brass frame of a revolving door, probably from a first-class lounge. It is the kind of painstaking work that only someone who knows every inch of the ship could perform—a tiny part of an enormous Where's Waldo? sleuthing project that could keep Bill Sauder busy for years.

A platinum ring set with diamonds was found in a leather pouch. Women sparkled in such jewels at the ship's fancy social events.



In late October I found myself in Manhattan Beach, California, inside a hangar-size film studio where James Cameron, surrounded by dazzling props and models from his 1997 movie, *Titanic,* had assembled a roundtable of some of the world's foremost nautical authorities—quite possibly the most illustrious conclave of *Titanic* experts ever gathered. Along with Cameron, Bill Sauder, and RMST explorer Paul-Henry Nargeolet, the roundtable boasted *Titanic* historian Don Lynch and famed *Titanic* artist Ken Marschall, along with a naval engineer, a Woods Hole oceanographer, and two U.S. Navy architects.

Cameron could more than hold his own in this

select company. A self-described "rivet-counting *Titanic* geek," the filmmaker has led three expeditions to the site. He developed and piloted a new class of nimble, fiber-spooling robots that brought back never before seen images of the ship's interior, including tantalizing glimpses of the Turkish bath and some of the opulent staterooms. (See "Ghostwalking in *Titanic*," page 100.)

Cameron has white hair and a close-clipped white goatee, and when he's wound up on *Titanic* matters, a certain Melvillean intensity weighs on his brow. Cameron has also filmed the wreck of the *Bismarck* and is now building a submarine to take him and his cameras to the Mariana Trench. But the *Titanic* still holds him; he keeps swearing off the subject, only to return. "There's this very strange mixture of biology and architecture down there—this sort of biomechanoid quality," he told me at his Malibu compound. "I think it's gorgeous and otherworldly. You really feel like this is something that's gone to Tartarus—to the underworld."

At Cameron's request, the two-day roundtable would concentrate entirely on forensics: Why did the *Titanic* break up the way she did? Precisely where did the hull fail? At what angle did the myriad components smash into the seabed? It was to be a kind of inquest, in other words, nearly a hundred years after the fact.

"What you're looking at is a crime scene," Cameron said. "Once you understand that, you really get sucked into the minutiae. You want to know: How'd it get like that? How'd the knife wind up over here and the gun over there?"

Perhaps inevitably, the roundtable took off in esoteric directions—with discussion of glide ratios, shearing forces, turbidity studies. Listeners lacking an engineering sensibility would have extracted one indelible impression from the seminar: *Titanic*'s final moments were hideously, horrifically violent. Many accounts depict the ship as "slipping beneath the ocean waves," as though she drifted tranquilly off to sleep, but nothing could be further from the truth. Building on many years of close analysis of the wreck, and employing state-of-the-art flooding models and "finite element" simulations used in the



In the Disaster's Wake

April 15, 1912 R.M.S. *Titanic* sinks 400 miles off the coast of Newfoundland.

April to July 1912 Inquiries by the U.S. Congress and the British Board of Trade spur changes in maritime safety, including rules for lifeboat capacity and mandatory 24-hour radio service by all ships at sea.

January 1914 The International Ice Patrol is established to monitor key shipping lanes. No ship since the *Titanic* has been sunk by an iceberg in the North Atlantic.

1955 Walter Lord's book *A Night to Remember* and the film based on it rekindle public interest in the disaster.

September 1, 1985 A French-American team led by Robert Ballard and Jean-Louis Michel locates the *Titanic* using the deep-sea robot *Argo*.

July 12, 1986 Ballard returns aboard *Atlantis II* and dives to the wreck in the submersible *Alvin*. He removes no artifacts, urging others to leave the site undisturbed as a memorial to the dead.

1987 Salvage operators begin to recover artifacts from the *Titanic* despite heavy criticism from the scientific community.

1994 A U.S. court declares RMS Titanic, Inc. (RMST) the wreck's sole "salvor-in-possession" because it was the first to recover artifacts from the site.

1997 James Cameron's film *Titanic* breaks box office records. He later claims he made the movie primarily so he could explore the wreck.

1998 First tourists dive in submersibles to *Titanic*, at a price of $32,500 each.

2000 RMST sues to stop the National Oceanic and Atmospheric Administration (NOAA) and Department of State from developing guidelines governing exploration and salvage of the wreck site. The suit is dismissed, and the guidelines are issued the next year.

May 31, 2009 Millvina Dean, the last *Titanic* survivor, dies at age 97. She was just ten weeks old when she was lowered to a lifeboat in a canvas mailbag.

2010 The first survey of the entire wreck site is conducted in an expedition led by RMST in collaboration with NOAA and the Woods Hole Oceanographic Institution.

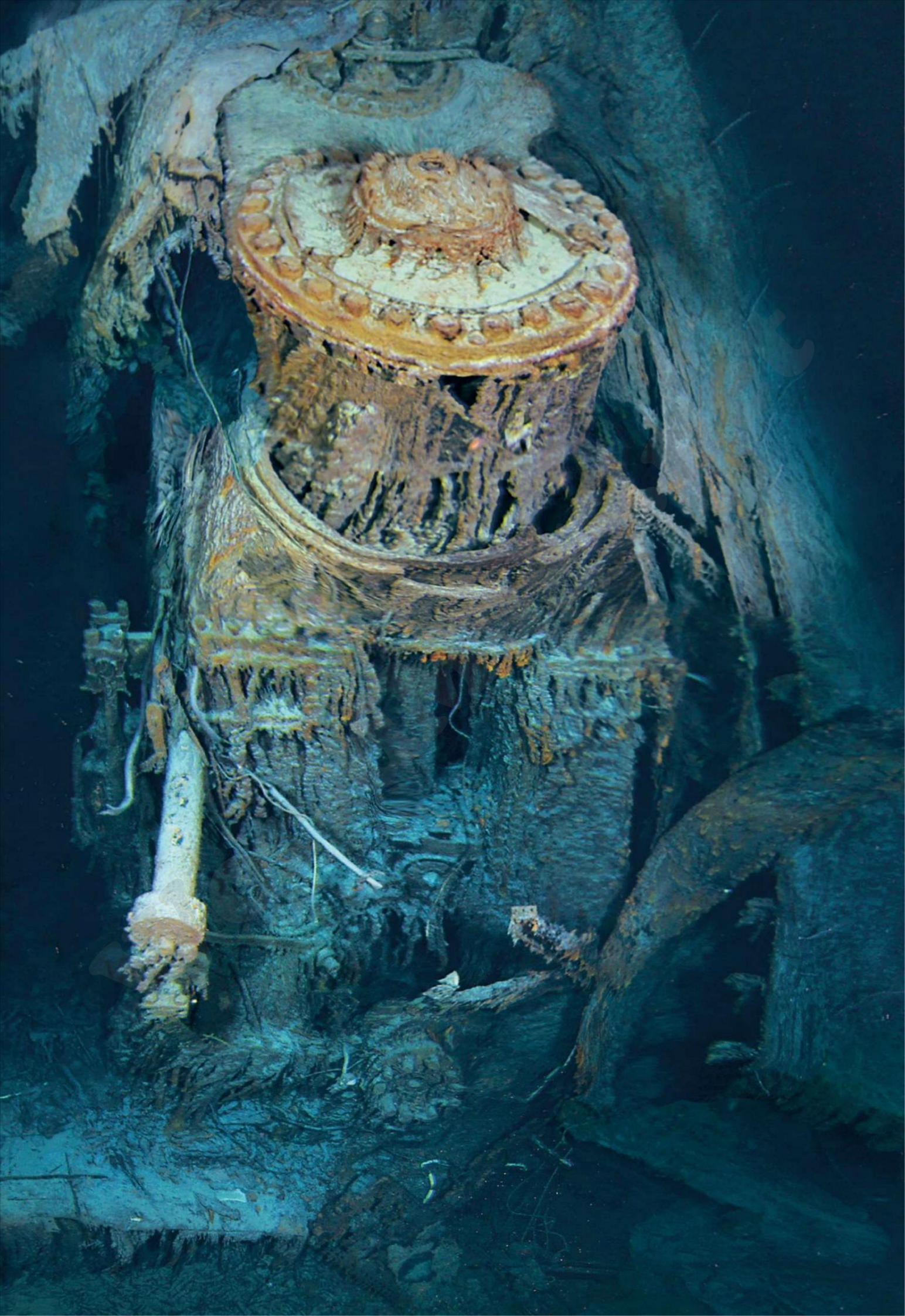
April 14, 2012 A hundred years after it struck the iceberg, the *Titanic* becomes eligible for protection as a UNESCO underwater cultural heritage site.

NGM Magazine



Two of Titanic*'s engines lie exposed in a gaping cross section of the stern. Draped in "rusticles"—orange stalactites created by iron-eating bacteria—these massive structures, four stories tall, once powered the largest moving man-made object on Earth.*

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modern shipping industry, the experts painted a gruesome portrait of *Titanic*'s death throes.

The ship sideswiped the iceberg at 11:40 p.m., buckling portions of the starboard hull along a 300-foot span and exposing the six forward watertight compartments to the sea. From this moment onward, sinking was a certainty. The demise may have been hastened, however, when crewmen pushed open a gangway door on the port side in an aborted attempt to load lifeboats from a lower level. Since the ship had begun listing to port, they could not reclose the massive door against gravity, and by 1:50 a.m., the bow had settled enough to allow seawater to rush in through the gangway.

By 2:18, with the last lifeboat having departed 13 minutes earlier, the bow had filled with water and the stern had risen high enough into the air to expose the propellers and create catastrophic stresses on the middle of the ship. Then the *Titanic* cracked in half.

Cameron stood up and demonstrated how it happened. He grabbed a banana and began to wrench it in his hands: "Watch how it flexes and pooches in the middle before it breaks—see that?" The banana skin at the bottom, which was supposed to represent the doubly reinforced bottom of the hull, was the last part to snap.

Once released from the stern section, the bow shot for the bottom at a fairly steep angle. Gaining velocity as it dropped, parts began to shear away: Funnels snapped. The wheelhouse crumbled. Finally, after five minutes of relentless descent, the bow nosed into the mud with such massive force that its ejecta patterns are still visible on the seafloor today.

The stern, lacking a hydrodynamic leading edge like the bow, descended even more traumatically, tumbling and corkscrewing as it fell. A large forward section, already weakened by the fracture at the surface, completely disintegrated, spitting its contents into the abyss. Compartments exploded. Decks pancaked. Hull plates ripped out. The poop deck twisted back over itself. Heavier pieces such as the boilers dropped straight down, while other pieces were

These boots lay in the leather suitcase of 35-year-old toolmaker William Henry Allen. Like many third-class passengers, he did not survive.



flung off "like Frisbees." For more than two miles, the stern made its tortured descent—rupturing, buckling, warping, compressing, and gradually disintegrating. By the time it hit the ocean floor, it was unrecognizable.

Sitting back down, Cameron popped a pinched piece of banana in his mouth and ate it. "We didn't want the *Titanic* to have broken up like this," he said. "We wanted her to have gone down in some kind of ghostly perfection."

Listening to this learned disquisition on the *Titanic*'s death, I kept wondering: What happened to the people still on board as she sank? Most of the 1,496 victims died of hypothermia at the surface, bobbing in a patch of cork life preservers. But hundreds of people may still have been alive inside, most of them immigrant families in steerage class, looking forward to a new life in America. How did they, during their last moments, experience these colossal wrenchings and shudderings of metal? What would they have heard and felt? It was, even a hundred years later, too awful to contemplate.

St. John's, Newfoundland, is another of *Titanic*'s homes. On June 8, 1912, a rescue ship returned to St. John's bearing the last recovered *Titanic* corpse. For months, deck chairs, pieces of wood paneling, and other relics were reported to have washed up on the Newfoundland coast.

I had hoped to pay my respects to the people who literally went down with the ship by flying to the wreck site from St. John's with the International Ice Patrol, the agency created in the disaster's aftermath to keep watch for icebergs in the North Atlantic sea lanes. When a nor'easter canceled all flights, I found my way instead to a tavern in the George Street district, where I was treated to a locally made vodka distilled with iceberg water. To complete the effect, the bartender plopped into my glass an angular nub of ice chipped from an iceberg, supposedly calved from the same Greenlandic glacier that birthed the berg that sank *Titanic*. The ice ticked and fizzed in my glass—the exhalations, I was told, of ancient atmospheres trapped inside.

I could still get a little closer, physically and figuratively, to those who rest forever with the ship. A few years before the disaster, Guglielmo Marconi built a permanent wireless station on a desolate, wind-battered spit south of St. John's, called Cape Race. Locals claim that the first person to receive the distress signal from the sinking ship was Jim Myrick, a 14-year-old wireless apprentice at the station who went on to a career with the Marconi Company. Initially, the transmission came in as a standard emergency code, CQD. But then Cape Race received a new signal, seldom used before: SOS.

One morning at Cape Race, amid the carcasses of old Marconi machines and crystal receivers, I met David Myrick, Jim's great-nephew, a marine radio operator and the last of a proud line of antique communicators. David said his uncle never spoke about the night the *Titanic* sank until he was a frail old man. By that point, Jim had lost his hearing so completely that the only way the family could converse with him was through Morse code—manipulating a smoke detector to produce high-pitched dots and dashes. "A Marconi man to the end," David said. "He thought in Morse code—hell, he dreamed in it."

We went out by the lighthouse and looked over the cold sea, which crashed into the cliffs below. An oil tanker cruised in the distance. Farther out, on the Grand Banks, new icebergs had been reported. Farther out still, somewhere beyond the bulge of the horizon, lay the most famous shipwreck in the world. My mind raced with thoughts of signals bouncing in the ionosphere—the propagation of radio waves, the cry of ages submerged in time. And I imagined I could hear the voice of the *Titanic* herself: A vessel with too much pride in her name, sprinting smartly toward a new world, only to be mortally nicked by something as old and slow as ice. □

Working Draft

Titanic
The Crash Scene

Visible for the first time through sonar imaging, the remains of the ship and its contents sprawl across a thousand acres of gently sloping seafloor. Combined with optical mosaics of individual artifacts (colored images), this map of the main wreck area will help experts explore, manage, and protect the Titanic *as a long-term archaeological site.*

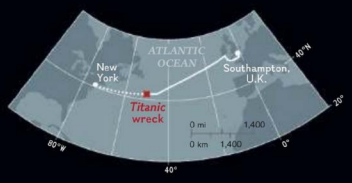
1. Cargo hatch number 1 cover
Forensic analysts believe the massive forward cargo hatch cover (1a) blew off its hatch (1b) when the bow slammed into the seafloor.

2. Davit pile
Titanic's lifeboats were hoisted overboard by davits, or small cranes. Most were raked off the deck by flailing funnel cables. These two were entangled by ropes left dangling after a boat was launched.

3. Aft grand staircase dome
Decorated like the forward grand staircase dome featured in the movie *Titanic*, the aft grand staircase led down to the deluxe à la carte restaurant, allowing patrons to arrive in style.

4. Single-ended boiler
Five 57-ton boilers rolled out of boiler room 1 like giant marbles when the hull split in two. The smallest on board, they were used to heat and light the ship when in port.

5. Double-bottom hull piece
Two sections of *Titanic*'s double-bottom hull (5a and 5b) ripped off the stern as it sank. Their hydrodynamic shape may account for their landing well to the east of the rest of the debris. How a collapsed pile of decking (5c) landed nearby remains a mystery.



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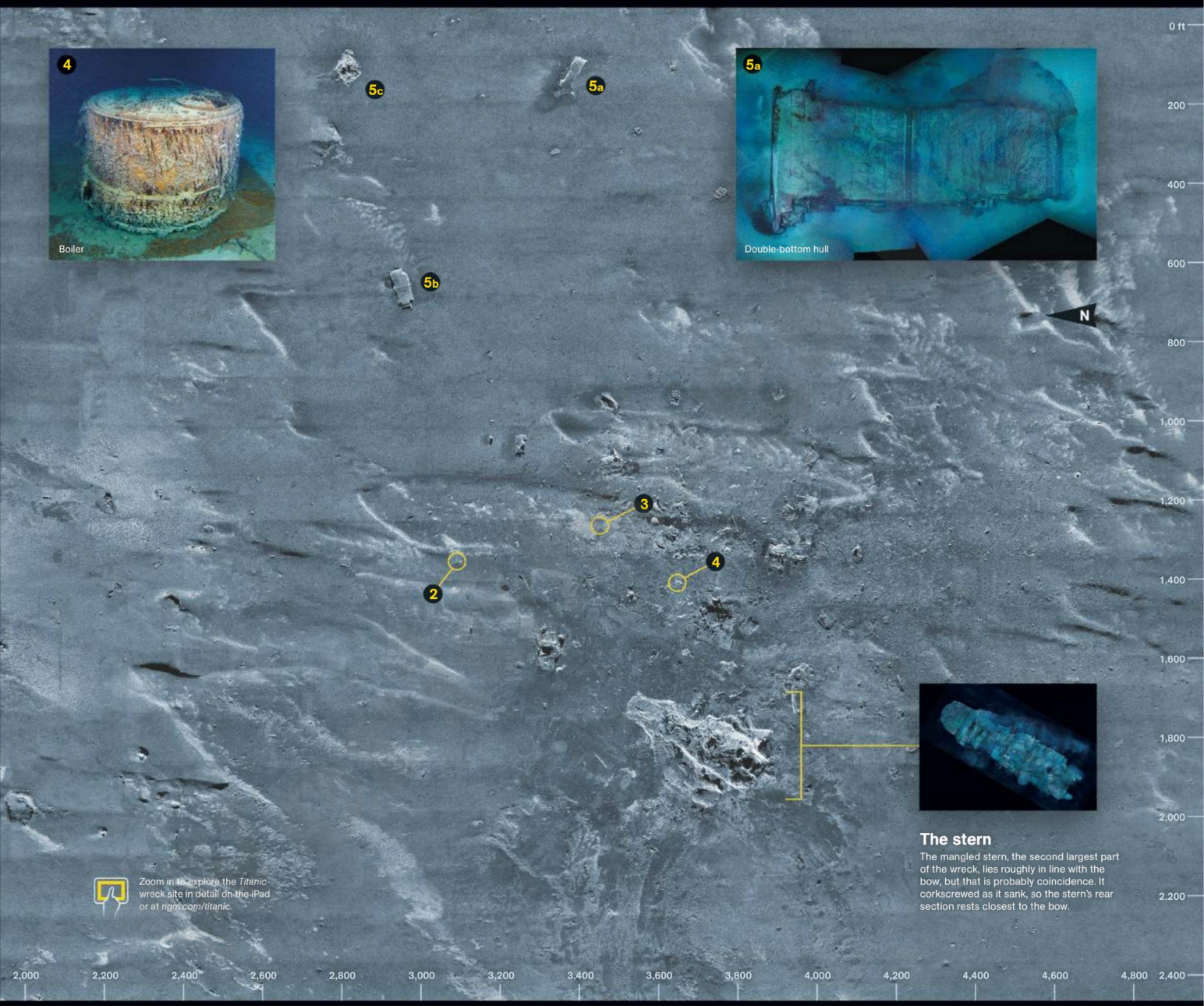
NATIONAL GEOGRAPHIC



The bow
Titanic's bow section, the largest piece of the wreck, lies some 2,000 feet from the main wreckage field. A shock wave of disturbed mud fans out behind.

Changing seafloor
Swirling bottom currents constantly sculpt the ocean bed, stirring sediments and building up dunes that are, in some cases, longer, wider, and higher than the *Titanic* itself. "It appears to be a much more dynamic environment than we realized," says Woods Hole oceanographer David Gallo. He believes many *Titanic* artifacts may lie beneath the ocean floor—and that one day shifting dunes and sediment flows could entirely bury the wreck.

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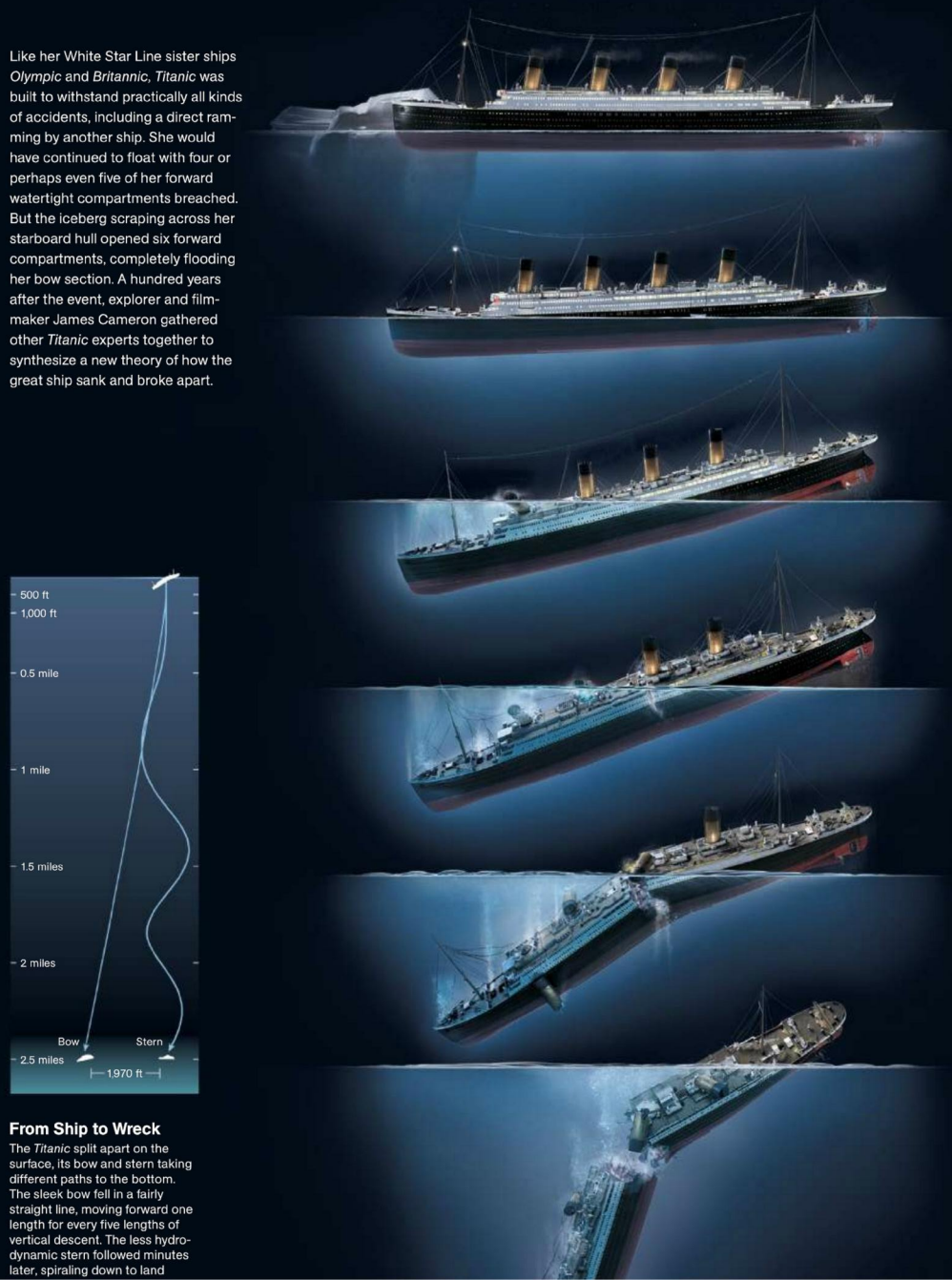
Zoom in to explore the *Titanic* wreck site in detail on the iPad or at *ngm.com/titanic*.

The stern

The mangled stern, the second largest part of the wreck, lies roughly in line with the bow, but that is probably coincidence. It corkscrewed as it sank, so the stern's rear section rests closest to the bow.

Death of the Titanic

Like her White Star Line sister ships *Olympic* and *Britannic*, *Titanic* was built to withstand practically all kinds of accidents, including a direct ramming by another ship. She would have continued to float with four or perhaps even five of her forward watertight compartments breached. But the iceberg scraping across her starboard hull opened six forward compartments, completely flooding her bow section. A hundred years after the event, explorer and filmmaker James Cameron gathered other *Titanic* experts together to synthesize a new theory of how the great ship sank and broke apart.



1912

April 14, 11:40 p.m.
An iceberg is sighted dead ahead, but *Titanic* is sailing at almost 21 knots and cannot be turned quickly enough to port to avoid a collision along her starboard side.

April 15, 1:50 a.m.
Two hours of steady flooding settles the bow. The ship gradually lists to port, and by about 1:50 a.m. the water reaches a gangway door open on the port side, increasing the list.

2:15 a.m.
The pressure of rising seawater buckles the boiler uptake supporting the number 1 funnel, and the funnel falls. Water floods in the new opening, accelerating the rate of sinking.

2:18 a.m.
The ship's water-heavy bow and its relatively buoyant stern begin an immense tug-of-war. The stress causes the hull to crack just in front of the third funnel.

2:18 a.m.
Seconds later, maximum bending stress breaks the hull, with bow and stern held together only by the reinforced hull bottom. The stern lurches to port, throwing people against the port rail.

2:19 a.m.
The bow pulls loose from the still buoyant stern, which briefly settles back almost level with the surface before angling down again as water floods its ruptured forward end.

From Ship to Wreck
The *Titanic* split apart on the surface, its bow and stern taking different paths to the bottom. The sleek bow fell in a fairly straight line, moving forward one length for every five lengths of vertical descent. The less hydrodynamic stern followed minutes later, spiraling down to land

almost 2,000 feet to the south of the bow.

KAITLIN M. YARNALL AND MATTHEW TWOMBLY, NGM STAFF. ART: NICK KALOTERAKIS
SOURCES: JAMES CAMERON; KEN MARSCHALL; CASEY SCHATZ; LT. CMDR. PARKS STEPHENSON, USN (RET.); CMDR. JEFFREY STETTLER, USN

Watch an animated version of the sinking on your iPad.

Tune in to the National Geographic Channel's *Titanic: The Final Word With James Cameron* on April 8.



2:20 a.m.
As the bow speeds toward the bottom, the stern angles almost to vertical, then disappears from the surface, shedding debris from its open end. Boilers tumble out and head straight down.

2:21 a.m.
Water flowing over the bow snaps the foremast back over the bridge and tears off funnels. About 500 feet down, air pockets in the stern implode, and it flips around to descend aft first.

Because of their flared shapes, both bow and stern descend in an undulating "stall and fall" pattern. The stern corkscrews down clockwise, shedding more debris before smashing into the sea bottom.

Moving at some 30 knots, the bow plows into the bottom at an angle of about 20 degrees, breaking the hull and collapsing decks. The tortured wreck of the stern pays witness to its more violent descent.

Distances not to scale. Final resting places of bow and stern are 1,970 feet apart.

NATIONAL GEOGRAPHIC

REMOVE POSTER HERE

Ghostwalking in Titanic

Wandering room to room through the sunken wreck, the explorer and filmmaker finds himself at home among the spirits.

BY JAMES CAMERON

IT HAD BEEN FIVE HOURS since my intrepid robot *Gilligan* left its garage on the front of the submersible *Mir 1* and disappeared inside the cavernous shipwreck. Our sub was parked on the upper deck of the most famous wreck in history, surrounded by eternal blackness and over 5,000 pounds per square inch of pressure, both thanks to a two-and-a-half-mile column of water over our heads.

Safe inside the *Mir,* I flew the remotely operated vehicle (ROV) with gentle nudges of the joystick, its thrusters maneuvering it into the ship's treacherous interior. The "bot" had penetrated to F Deck, paying out a thin fiber-optic cable like Theseus in the labyrinth, with only Ariadne's twine to guide him back. Though the tiny vehicle was now seven decks below me, I felt as if my consciousness were inside the bot, its cameras my eyes, staring down the corridors of the ship. Its jeopardy was also mine, and my pulse raced with each new hazard. Turning a corner, I barely escaped being pinned by a falling "rusticle," one of the stalactite-like formations created by the bacteria that are slowly devouring the steel of the ship.

As I passed through an entrance, suddenly revealed in my lights were sparkling reflections off a wall of gleaming blue and green tiles. Teak chaise lounges lay upturned on the floor, incredibly well preserved, and above them was an arabesque dome covered in gold leaf. I had entered the elegant spa on the most luxurious ship of its time. "Tell them we're in the Turkish baths," I said to Mike Arbuthnot, the marine archaeologist

Explorer-in-Residence James Cameron's next expedition is a solo dive to the Mariana Trench.



James Cameron gathers Titanic *experts in a California film studio to brainstorm over how the ship sank and broke apart. Their forensic tools included a 42-foot model, hours of dive footage, site maps, and computerized sinking simulations.*

sitting next to me. He keyed the microphone and relayed the message up to the surface.

Our interior archaeological survey of the ship had begun in 1995, as I was wrapping up shooting the wreck for the movie *Titanic.* Back then we had an unwieldy ROV called *Snoop Dog,* which was little more than a movie prop, but we flew it down inside the ship's grand staircase nevertheless, all the way down to D Deck. Its lights revealed that much of the ornate wood paneling remained intact. *Snoop* reached the end of its tether and could go no farther, but I could not help wondering what lay in the shadows just beyond its lights. After the movie *(Continued on page 108)*

STEWART VOLLAND





Weeping rusticles, a 15-ton anchor hangs from the port side of the ship. The starboard anchor was deployed for stops in Cherbourg, France, and Queenstown, Ireland, but this one was never used. A fallen section of the bow's steel railing lies nearby on the sediment of the seabed.

WALDEN MEDIA

WorldMags.net

The Promenade

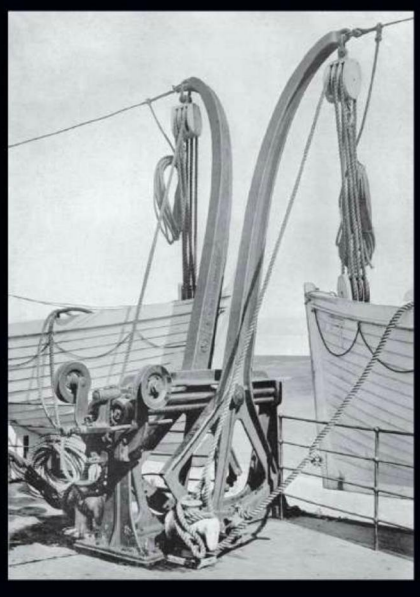
Lights from a submersible penetrate the rusted ruin of Titanic*'s first-class promenade, once as inviting as a similar deck on the* Olympic *(right). Before the* Titanic *sank, the windows were opened, probably to load lifeboats. Millionaire John Jacob Astor IV put his 18-year-old wife into lifeboat 4 through a promenade window on the other side of the ship. He stayed on board and perished.*



DISCOVERY CHANNEL, MOSAIC BY KEN MARSCHALL (TOP); © NATIONAL MUSEUMS NORTHERN IRELAND, COLLECTION HARLAND AND WOLFF, ULSTER FOLK & TRANSPORT MUSEUM

Lifeboat Station

A single davit survives on the deck above the promenade. Two such small cranes, one at each end, were needed to lower a lifeboat to the sea. This one helped launch collapsible boat C, where J. Bruce Ismay—chairman of the company that owned the Titanic*—took a seat and rode to safety. Block and tackle link* Olympic*'s davits to two of her lifeboats (right).*



WALDEN MEDIA (TOP); AVERY HISTORICAL MUSEUM



The Turkish Bath

Ceramic tiles framed in durable teak shimmer in the first-class spa. "For the first time in a hundred years, we see what passengers experienced in 1912," says Ken Marschall, who created views of sunken interiors by stitching together multiple video frames. The facility on the Olympic *(right) displayed the arabesque splendor that inspired the spa's name on both ships.*



DISCOVERY CHANNEL, MOSAIC BY KEN MARSCHALL (TOP); BYRON COLLECTION, MUSEUM OF THE CITY OF NEW YORK

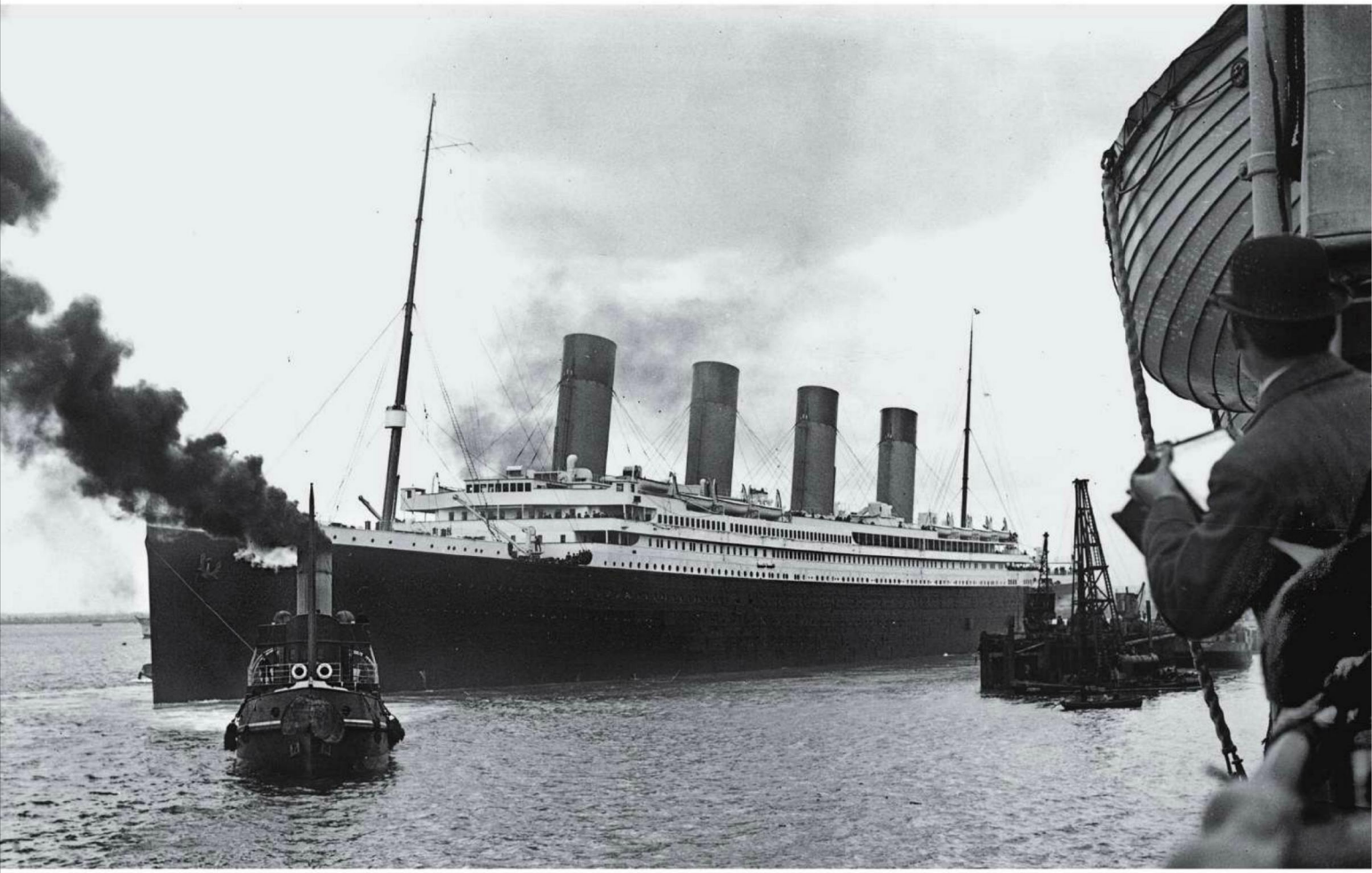


Sailing in Luxury

A gilded clock rests intact on an electric fireplace in the elegant Straus suite, which looked like the one on the Olympic *(right). Isidor Straus, an owner of Macy's department store, and his wife, Ida, died together after she refused to get into a lifeboat without him. His body was found wearing a fur-lined coat, a gray suit, brown boots, and black silk socks.*



DISCOVERY CHANNEL, MOSAIC BY KEN MARSCHALL (TOP); © NATIONAL MUSEUMS NORTHERN IRELAND, COLLECTION HARLAND AND WOLFF, ULSTER FOLK & TRANSPORT MUSEUM



As a tugboat guided the Titanic *out of Southampton, photographers recorded the moment from a nearby ship. Five days later this symbol of the gilded age lay at the bottom of the North Atlantic. "It's one of those stories that will always be told," says explorer Robert Ballard.*

(Continued from page 101) was released, I commissioned the building of two revolutionary new robotic vehicles so we could return and truly explore the interior. In 2001 and again in 2005 I made multiple dives to the *Titanic* wreck and flew our bots deep inside, exhaustively surveying her interior. Ultimately we imaged and documented 65 percent of *Titanic*'s surviving internal spaces, including the first-class cabins, first-class reception and dining rooms, steerage cabins and open space, cargo holds, and Marconi room.

One incredible discovery followed another, in dizzying succession. In the first-class dining saloon and reception rooms, we found the tall leaded windows still intact. The hand-carved mahogany paneling on the walls and columns remains, some of it with the original white paint still visible. There are cut crystal chandeliers and,

in the first-class staterooms, immaculately preserved brass beds. Filigreed iron grilles cover the yawning elevator shafts. When I first laid eyes on the intact brass call button, I felt as if I could reach out and touch it, and a ghostly elevator might still arrive. *Titanic* sank on her maiden voyage before her interiors could be photographed, so most of the archival images used as references for the movie's sets were photos of her sister ship, *Olympic*. For the first time we were learning how *Titanic* herself was actually built, and the details of her decoration have now been painstakingly reconstructed from the bot videos. I now know where the movie is accurate, and where it's not.

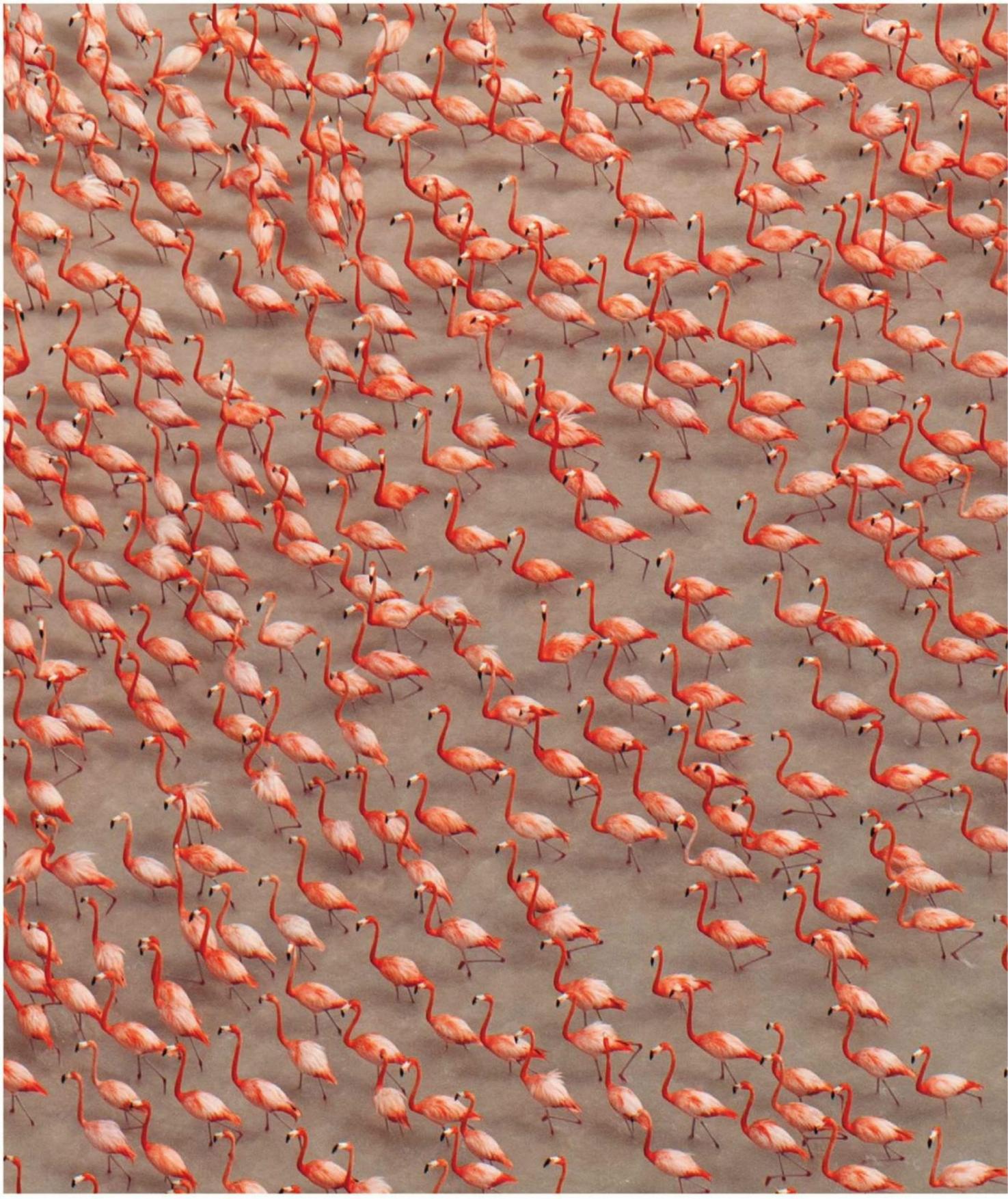
Of all our discoveries, the most evocative are the relics that suggest the human hands that touched them. In Henry Harper's D Deck cabin, his bowler hat remains in the ruins of his closet, right where he left it. In Edith Russell's cabin on A Deck, the mirror still gleams in her washstand, reflecting back the bot's LED lights instead of Edith's terrified face as she rushed back into the room to get her lucky toy pig before running to board a lifeboat. In another stateroom, a glass decanter and water glass sit, impossibly, still on the washstand. Had the glass been empty, it would have floated out of its holder when the room flooded, and been lost. But someone took a drink and left it half full, and there it sits today.

In the soundproof Marconi room, the wireless apparatus survives, the knife switches still in the positions left by the young operators, Harold Bride and Jonathan Phillips, revealing that they cut the power when they abandoned their post as the water rushed up the deck outside. We even imaged the transformer they had repaired just the night before the sinking. Acting against guidelines, the two young wireless geeks managed to restore the set to full power—an act that may have saved 712 lives, since without this power they might not have reached the rescue ship *Carpathia* with their historic SOS. Capturing these precious bot images was like touching history itself.

In 2001 I had wanted to get into the C Deck suite of Ida and Isidor Straus, the elderly couple famous for choosing to die together rather than be separated by the evacuation rule of "women and children only." Their suite was the most ornately decorated on the ship, and in fact had been the basis for Rose's suite, the room in which Jack Dawson draws the heroine's portrait in my fictional narrative. I got our stalwart bot *Jake* as far as the purser's office, discovering the tall purser's safe in the process, but I couldn't penetrate to the Straus suite next door. In 2005, determined to find a way, I wriggled the slightly smaller *Gilligan* through a constriction, knocking rusticles out of the way, and emerged into an open space. The bot's lights revealed gleaming gold sparkles. Not only was the ornate mahogany fireplace still intact, but sitting on it was the gold-plated clock, just as it appeared in the archival photo, and just as we had re-created it for the movie. It was a surreal moment, fiction and reality merging in the stygian depths.

AFTER 33 DIVES to the wreck, averaging 14 hours each, I have spent more time on the ship than Captain Smith himself did. In all that exploration, the strongest memories are these out-of-body experiences of ghostwalking through the corridors and stairwells of *Titanic* via my ROV avatar. Its gothic ruin exists now in a ghostly limbo, neither in our world nor completely gone from it. The rusticles have transformed Edwardian elegance into a phantasmagorical cavern, a surreal underworld ruled only by dream logic. But despite the sheer alienness of the place, I felt a tingling déjà vu exploring there. Having walked the faithfully built movie set for many weeks, I would turn a corner in the wreck and already know, before the bot's video camera revealed it, what would be there. It was an eerie feeling but also strangely comforting, as if I were somehow home. □

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Flamingos, fiercely loyal in wild flocks, move in unison when there is a threat. Here, near Sisal, Mexico, a research plane is passing overhead. Several major breeding groups live in estuaries around the Caribbean and beyond.

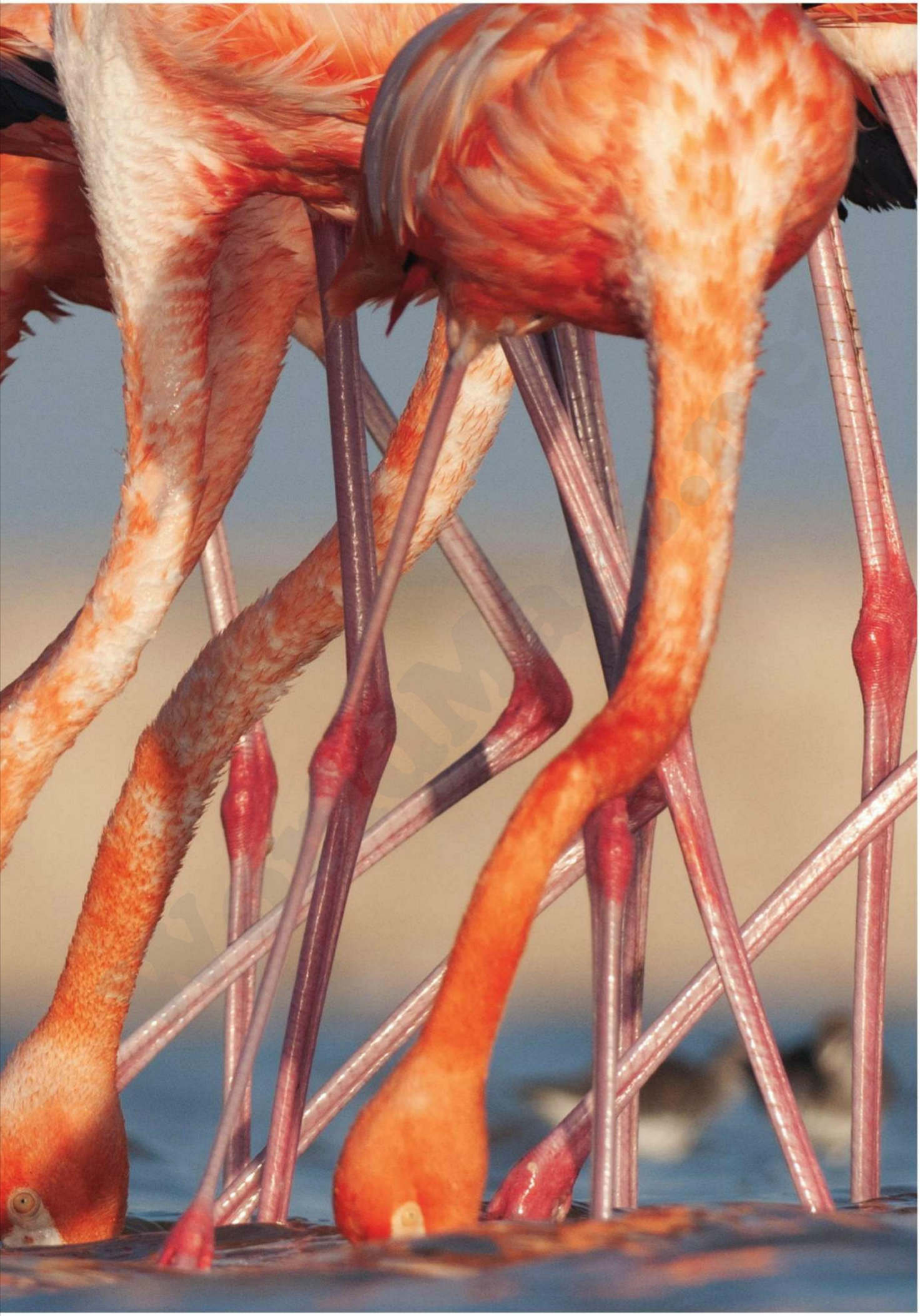


birds of a feather

Photographs by Klaus Nigge



Pigments in brine shrimp, abundant in the Yucatán where these flamingos were photographed, lend the birds' feathers their coral hue.





A flamingo looks like a bird cooked up by an exuberant preschooler—absurdly long legs, knobby ankles (that look like knees), a snaky neck, and an outsize beak—and colored with the brightest crayon in the box. But the sum of its physical oddities enables the Caribbean flamingo to thrive in salt pans, mudflats, tidal lagoons, and mangrove swamps. With its hooked bill it scrapes up clumps of mud to make a nest. Stiff bristles inside its bill filter water containing small crustaceans, mollusks, insects and their larvae, as well as aquatic vegetation.

And the glorious feathers? They seem to exist purely for our delight, but in fact they are not pink at first. Chicks hatch with white feathers that turn gray—and later take their pink color from aqueous bacteria and beta-carotene obtained from their food.

Although flamingos have become a visual cliché immortalized in cheap plastic lawn ornaments, they remain strangely mysterious. "As recognizable as they are, we don't know much about them," says Chris Brown, curator of birds at the Dallas Zoo and Children's Aquarium, who studies the flamingos on Mexico's Yucatán Peninsula. Scientists are uncertain about even simple behaviors, like the propensity to stand on one leg. (Some postulate that it has to do with the way the birds rest.) And because flamingos live in such remote areas and pick up and move as feeding grounds flood or dry out, researchers have a hard time counting and tracking them—or learning how they may be affected by drought, hurricanes, and fluctuating water levels due to climate change or coastal development.

What we do know is that flamingos in large flocks in the wild are gregarious and fiercely loyal. They perform group mating dances. Parents dote on chicks, gathering them into crèches for protection while both males and females fly off to search for food. And when danger looms, thousands move as one—a ballet that may increase the odds of survival in a perilous world. *—Nancy Shute*

Prospective parents use their beaks to scrape together a nest mound for their egg. When it hatches, the proud pink parents feed their chick crop milk, an elixir rich in fat and protein that both parents produce in their digestive tracts and regurgitate.

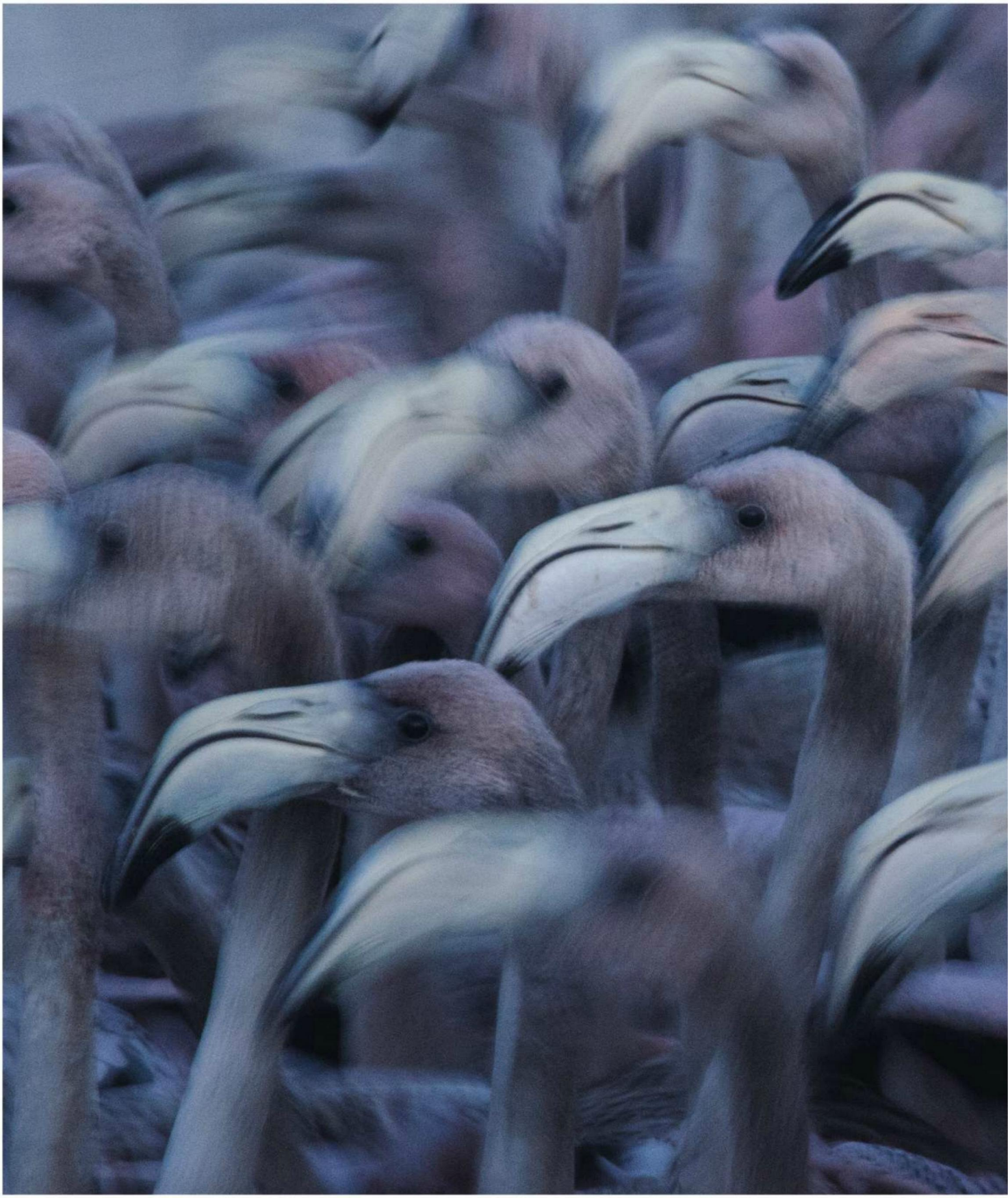


NG MAPS. SOURCE: CORNELL LAB OF ORNITHOLOGY





When chicks are a few weeks old, parents leave them in a crèche and go in search of food, taking turns coming back day and night to feed them. Though watched by a few adults, the young are vulnerable to predators such as dogs and jaguars.





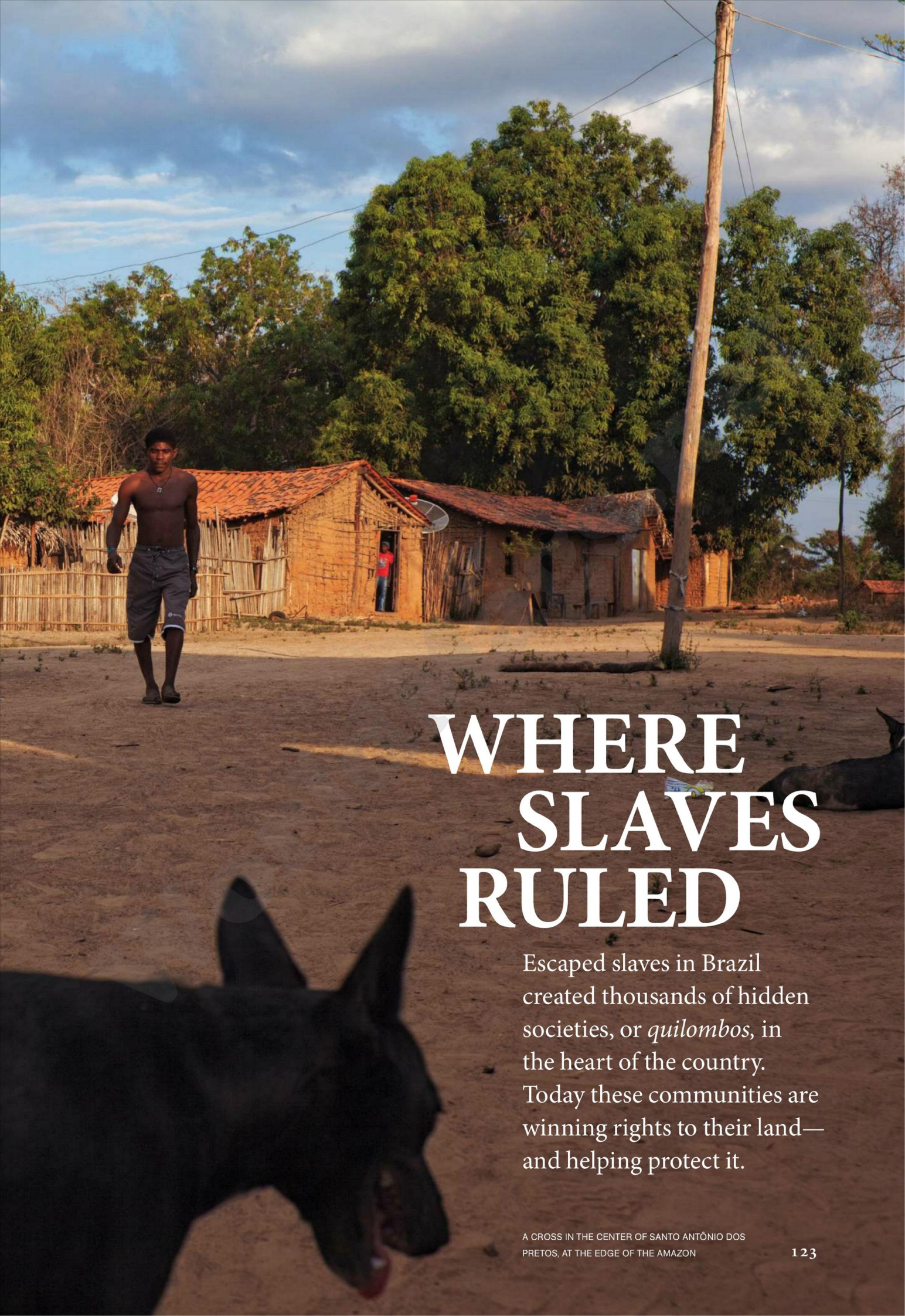
Roused before dawn and herded into an enclosure to be banded before they begin their travels, young flamingos huddle in Mexico's Ría Lagartos Biosphere Reserve. Flocks may move hundreds of miles together in search of food.





A Caribbean flamingo runs to take off from the shallow backwaters of Ría Lagartos. The birds are adept aviators, whether flying alone or in flocks.





WHERE SLAVES RULED

Escaped slaves in Brazil created thousands of hidden societies, or *quilombos*, in the heart of the country. Today these communities are winning rights to their land—and helping protect it.

A CROSS IN THE CENTER OF SANTO ANTÔNIO DOS PRETOS, AT THE EDGE OF THE AMAZON





Swirling to West African rhythms, residents of the Santa Rosa dos Pretos quilombo celebrate the recovery of a sick neighbor with a tambor de crioula, *a "creole drum" festival that mixes African and European traditions.*

By Charles C. Mann and Susanna Hecht
Photographs by Tyrone Turner

IMAGINE FLYING, impossibly, over the Earth in the 17th century—during the time described in American history books as the colonial period, when Europeans swarmed into the New World to dominate an almost empty wilderness. Instead, you would see tens of millions of native people already living in the Americas, joined by an extraordinary flow not of European colonists but of African slaves. Up until the early 19th century, almost four times as many Africans as Europeans came to the Americas. Looking down from above, you wouldn't know that the tiny numbers of Europeans were supposed to be the stars of the story. Rather, your attention would focus on the two majority populations: Africans and Indians.

You'd have a lot to watch. By the tens of thousands, African slaves escaped the harsh conditions of the European plantations and mining operations and headed for the interior, into lands controlled by Indians. Up and down the Americas, ex-slaves and indigenous peoples fashioned hybrid settlements known as maroon communities, after the Spanish *cimarrón,* or runaway.

Largely conducted out of sight of Europeans, the complex interplay between black and red is a hidden drama that historians and archaeologists have only recently begun to unravel. Nowhere is the presence of this lost chapter more in evidence than in Brazil, where thousands of maroon communities are emerging from the shadows, reaffirming their mixed culture and pressing for legal title to the land they have occupied since the era of slavery. The stakes are high: New laws are giving Brazil's maroon communities, called *quilombos* (the word for "settlement" in the Angolan language of Kimbundu), a key role in determining the future of the great Amazon forest.

MACAWS SCREECH OVERHEAD as the little boat motors upstream, water hyacinth rocking in its wake. The vessel is traveling through the lower Amazon Basin, riding from the mouth of the great river along a tributary to the hamlet of Baixo Bujaru. The village in the northern state of Pará has changed surprisingly little since the 18th century, when it was established by slaves who had escaped from their Portuguese masters. Little more than a school and a community building surrounded by airy wooden houses, it has no electricity, running water, or medical care and is accessible only by boat. Multiple hands pull in the boat as it approaches the main dock. Waiting are almost a hundred people who have come to meet the visiting medical team: a doctor, dentist, nurse, nurse-practitioner—and two beauticians. "Is it true that in other countries you don't get a facial and your dreads done with your Pap smear?" the pilot asks. "Brazil is a civilized nation!"

During centuries of slavery roughly five million African captives were brought to Brazil. Almost as soon as they were put to work, the slaves began slipping out of their masters' control, creating fugitive worlds in the country's interior. Protected by a labyrinth of rivers and



Recaptured runaways were bound by leg cuffs and iron "necklaces" designed to inflict pain.

impenetrable forest, these illicit settlements endured for decades, even centuries.

Brazil abolished slavery in 1888, the last nation in the hemisphere to do so. But the end of slavery did not mean an end to discrimination. Tucked into remote pockets, Brazil's maroon people, known as Quilombolas, continued to conceal themselves, staying so far from official sight that by the middle of the past century most policymakers believed they no longer existed. In the 1960s Brazil's military rulers decided to open up the Amazon Basin—it was, they argued, the nation's destiny. Land speculators poured in, feeding a classic real estate bubble. Hoping for quick money, they put huge areas to the ax, planted grass for ranches, and looked for the next buyer. Any people found on the property were deemed to be squatters and driven out, often at gunpoint. Countless quilombos were erased. But many managed to survive, Baixo Bujaru among them.

In the waiting crowd in Baixo Bujaru was Bettina dos Santos, the pilot's mother, born about 70 years ago in a house 45 minutes upriver. In those days there was no school. Nor were there any legal protections when the generals sliced Baixo Bujaru into ranches and sold them to politically connected investors. Armed men cut down maroon forests and placed cattle on the denuded results. With the local church, dos Santos says, she helped organize protests. "But we couldn't stop it—they had too many guns."

In the 1980s geologists discovered valuable bauxite (aluminum ore) and kaolin (a fine clay used to coat paper) in the next watershed over, also occupied by Quilombolas. Once more the state freely distributed their land, licensing it to mining companies. "So again we let them know we were here," she says. This time they were successful. In March 2008 Baixo Bujaru and its neighbors gained title to their land.

By U.S. standards, dos Santos's living room is bare: a small table with family photos, a bookcase against one wall. Yet the woman who grew

Charles Mann is the author of 1493: Uncovering the New World Columbus Created, *which has a chapter on maroon societies adapted from reporting for this article. Susanna Hecht is the co-author of* The Fate of the Forest. *Photographer Tyrone Turner has documented youth issues in Brazil.*

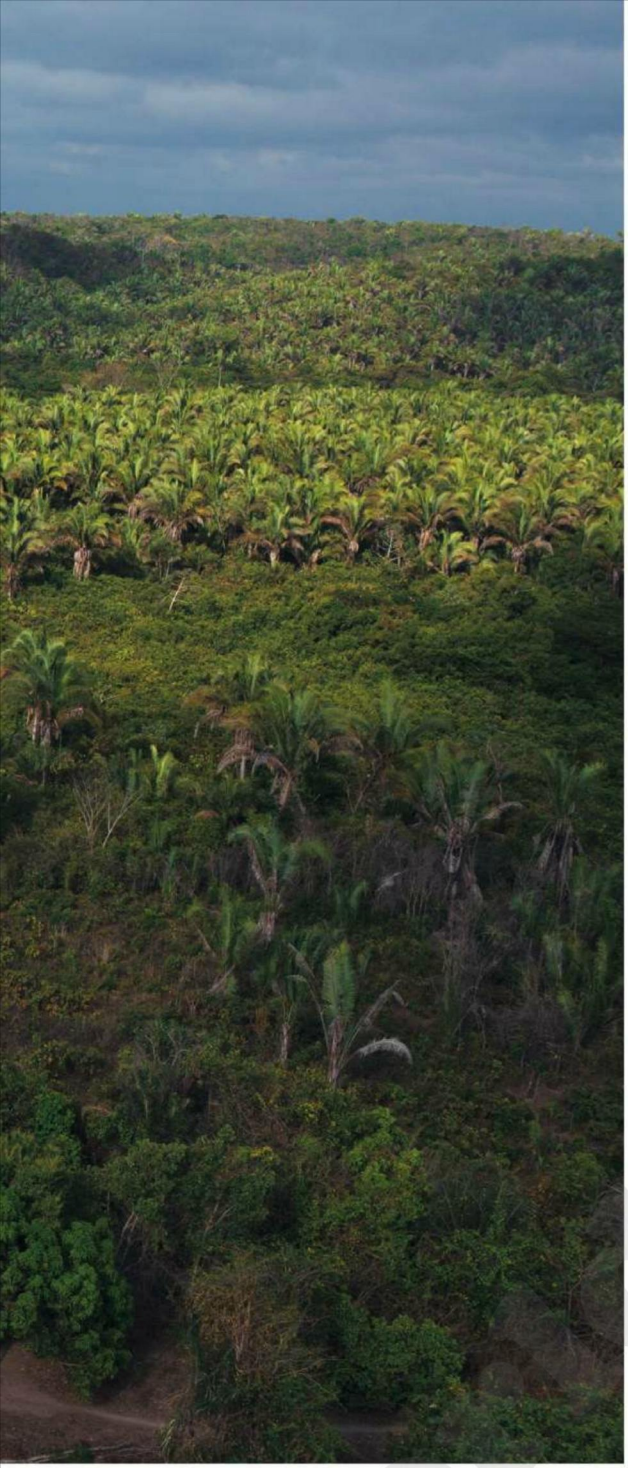
JEAN-BAPTISTE DEBRET (1835), GIRAUDON/BRIDGEMAN ART LIBRARY INTERNATIONAL



A hundred families harvest a meager living from the palm forests near the village of Santo Antônio dos Pretos. The quilombo was founded by escaped slaves two years before emancipation in 1888.

up with no access to medical care is now visited by a boatload of doctors and beauticians every few months. Dos Santos could not attend school and risked her life to protest deforestation. Now her daughter is studying for her Ph.D.; her son works for a farmers association. Smiling proudly from photographs, they are living testaments to the way Quilombolas have moved from invisibility to citizenship.

THE ATLANTIC SLAVE TRADE was a massive enterprise with tentacles that reached everywhere in the Americas, from Boston to Buenos Aires. But its center was the Portuguese colony of Brazil: For every African who landed in British North America, 12 arrived in Brazil, most of them destined for gold mines and sugar plantations, brutal work that killed a third to a half of them within five years. Sugar harvesting required hacking down hard, sticky, bamboo-like cane stalks in the baking sun; sugar processing involved boiling away the juice in smoking cauldrons. Little wonder the slaves quickly made for the exits, creating the most renowned quilombo



of all: Palmares, which at its height in the mid-17th century held sway over 10,000 square miles in the north coastal mountains.

The founder of this maroon nation was said to be Aqualtune, an Angolan princess and general enslaved in a Congolese war in about 1605. Soon after arriving in Brazil, the pregnant Aqualtune escaped with some of her soldiers and fled to the Serra da Barriga, a series of abrupt basaltic extrusions that dominate the coastal plain like a line of watchtowers. On one high crest was a pool of water sheltered by trees, with an indigenous community living around it. Here, according to legend, Aqualtune built Palmares.

Today Palmares is a national park in the state of Alagoas reached only by a rutted, muddy, unmarked road that can easily rip out a car's oil pan. A plaque by the high-crest pond recounts Aqualtune's story—to the distress of historians, because nobody knows how much of it is true. What researchers do know is that the quilombo's dozen villages became a haven for as many as 30,000 Africans and Indians, as well as a few renegade Europeans. It had roughly as many

Twelve Africans landed on Brazil's shores for every one who arrived in North America.

inhabitants at the time as all of British North America. By the 1630s, Aqualtune's son, Ganga Zumba, ruled Palmares from a palace with rich decorations, lavish feasts, and cringing minions.

Ganga Zumba's subjects used African-style forges to make metal plows and scythes for use in Indian-style mixed fields of corn, rice, and manioc and agricultural forests of palm and breadfruit. Around the settlements were protective palisades, pits filled with deadly stakes, and paths lined with lacerating caltrops. If attackers struck an outlying village, its people fled to the high outcrops, where fertile soils and artesian water made it possible to outlast any siege.

Lisbon saw Palmares as a direct challenge to its colonial state. Not only did maroon troops raid Portuguese settlements; they also blocked further European expansion into the interior. Enraged and fearful, Portugal launched more than 20 attacks on Palmares, always unsuccessfully. But the constant strife wearied Ganga Zumba, who agreed in 1678 to stop accepting new fugitives and move out of the mountains. Rejecting what he viewed as a betrayal, Ganga Zumba's nephew Zumbi poisoned his uncle and tore up the treaty. In reprisal, colonial forces assaulted the Serra da Barriga year after year. The Portuguese finally destroyed Palmares after a terrible siege in 1694, killing hundreds of its residents.





After Brazil's coastal forests were leveled for sugarcane plantations in the 16th century, millions of slaves were imported from Portuguese Africa. Today farms like this one in the northeast near Rio Formoso produce sugarcane for ethanol, a major export.



Once dismissed as squatter communities, quilombos in modern Brazil are stepping forward to gain legal status.

The quilombo was never rebuilt, but Zumbi and Palmares remained a symbol of resistance.

At first glance, the surviving quilombos look like other poor Brazilian villages. But most retain cultural elements of their residents' African homeland, mixed with European and native traditions. Brazil has a host of hybrid spiritual regimes—*candomblé, umbanda, macumba, terecô*—in which Afro-Brazilians dance, drum, and practice the dancing martial art of capoeira. In their isolation, quilombos built pageants and festivals atop these spiritual traditions, tying communities together with the supple bonds of shared memory. Across Brazil's north and northeast quilombos celebrate Bumba-Meu-Boi, a festival that satirically retells the tale of slaves escaping their fate with the help of Brazil's original inhabitants. The struggle for freedom is revisited even more overtly in the ritual dance of Lambe-Sujos, in which "runaway slaves," many covered head to foot in shimmering black oil, suck on baby pacifiers, symbolizing the cruel circular plugs strapped into the mouths of recalcitrant slaves. Clinging together in a spirit of resistance, the Quilombolas are celebrating their history even as they preserve it.

THE QUEST TO SAVE the rain forest has had unintended consequences for quilombos. The 1970s surge in Amazonian deforestation set off a worldwide furor. Chico Mendes, a kind of Brazilian Martin Luther King, led a campaign to recognize both the importance of the Amazon forest and the rights of its "traditional peoples," including quilombo residents. Meanwhile, the military dictatorship unraveled in a welter of inflation and scandal. Brazil enacted a new, democratic constitution in October 1988. Two months later Mendes was killed by a rancher-hired assassin. But it was too late to stop his cause: The new constitution protected the rights of traditional peoples. Along the way, it declared that quilombo communities were "the legitimate owners of the lands they occupy, for which the

NGM MAPS

State shall issue the respective title deeds."

"Nobody understood the implications at the time," says Alberto Lorenço Pereira, undersecretary for sustainable development in the Brazilian ministry of long-term planning, which formulates land policy. The framers of the constitution, he says, pictured "a few remnant quilombos somewhere in the forest" whose elderly members would be rewarded with their fields. Now it is widely believed there may be 5,000 or more maroon communities in Brazil, many of them in the Amazon Basin, occupying at least 30 million hectares—115,000 square miles, an area the size of Italy. Conflict was inevitable, Pereira says. "A lot of other people want that land."

Irate ranchers, miners, planters, land speculators, and plantation owners charged that many quilombo territories were not ancient legacies of slavery but modern land grabs—squatters trying to make a quick buck by pretending to be something they weren't. "There was an explosion of resentment," says Manuel Almeida, head of the Terras Quilombos de Jambuaçu, an association of 15 maroon communities in the lower Amazon. "People in the state senate questioned our legitimacy and tried to help the oil palm farmers and mining companies" that wanted quilombo land, he says. Between 1988 and 2003, just 51 land titles were granted to quilombo communities. Jambuaçu got its titles in the fall of 2008, but only after a long, bitter fight with ranchers and miners.

Brazil has had trouble deciding exactly what a quilombo is. Initially the definition—a community of descendants of escaped slaves—seemed unproblematic. But how should the law treat places like Frechal, in Brazil's eastern forest, where slaves who helped rid their master of debt were given land as a reward but still were persecuted by postcolonial planters? What about Acará, in the lower Amazon state of Pará, where an owner is said to have given his plantation to a slave he loved—but didn't provide her with the title? Or the lands in Tocantins, the state southeast of Pará, that in the 1860s were given by the government to slave militias as a reward for serving in a war against Paraguay? Strictly speaking, not one of these settlements was created by runaways. Yet all of them were autonomous communities founded by Africans, joined by Indians, with hybrid cultures, lengthy histories of bad treatment, and no recognizable legal titles to their land. Should they be pushed out of their homes?

To resolve the disputes, then President Luiz Inácio Lula da Silva ruled in November 2003 that a quilombo was any community that identified itself as a quilombo and had "African ancestry related to a history of resistance to historical oppression." Following Lula's decree, quilombos

The land the quilombos are claiming is the most valuable in the Amazon.

came out of the shadows in such numbers that they overwhelmed the agencies evaluating their claims. Some 1,700 quilombos have been officially recognized, and the number is growing as previously invisible communities come forward.

As the list of claimants grew, business interests and environmentalists realized with alarm that these small Afro-Indian settlements stood to acquire huge swaths of the Amazon. Worse yet, from their perspective, since many quilombos were built on fertile land with river access, some of the maroon land was the most valuable property in the river basin.

TO AN OUTSIDE VISITOR the farm owned by Maria do Rosário Costa Cabral and her family in the state of Amapá looks like an untouched tropical landscape: tall trees and luxuriant vines, muddy soil covered with rotting vegetation. Yet almost every species in it was selected and tended by Costa Cabral and her siblings. Over the years they planted lime, coconut, *cupuaçu* (a relative of cacao), and *açaí* (a palm fruit popular for its allegedly high antioxidants). At the river's edge they carefully encouraged shrubs and planted fruit trees that lure fish into the forest in high water. Yet it all looks wild, at least to outsiders.

The farm is near Mazagão Velho, a town founded in 1770 by Portuguese colonists from



Maria Tereza Costa removes the husks from rice in typical West African manner—with mortar and pestle—before preparing food for her family in Samucangaua, a quilombo in the state of Maranhão.

Morocco who had been ordered by Lisbon to resettle in Amapá, where their presence was supposed to thwart potential incursions by colonists in French Guiana to the north. To ease the transition, the colonists were awarded several hundred slaves. The new town was designed as a European-style city with graceful squares and gridded streets. Quickly the colonists made the unhappy discovery that Mazagão Velho was incredibly humid. Within a decade of arrival, the colonists—malarial, living in wretched shacks they were too poor to repair—begged the crown to relocate them. Ultimately, almost all the colonists slipped away. Through no act of their own, their slaves found themselves alone.

They were free as long as they pretended they weren't. The Portuguese wanted to be able to report to the King that a settlement was guarding Brazil's northern flank, and Mazagão Velho filled the bill. As the years went by, the descendants of the colony's Africans spread out into the countryside. Living along the rivers like the region's indigenous peoples, the masterless slaves survived the same way their Indian neighbors did: The river supplied fish and shrimp, small-scale gardens yielded manioc, trees provided everything else. Two centuries of constant planting, tending, and harvesting structured the forest. Mixing together native and African techniques, they created landscapes lush enough to be mistaken for untouched wilderness.

Costa Cabral is a strong, watchful woman of 62, born in a poor quilombo called Ipanema.



Jacey Mendes of Santiago "kills the hunger" with a shot of cachaça, or sugarcane rum. She's helping clear land to grow cassava root using a slash-and-burn method that some sharecroppers have come to rely on.

Her father spent his days searching the forest for rubber trees, native to the Amazon, and tapping the saplike latex beneath their bark. If he found an especially productive group of trees, he knew that wealthier, more powerful people eventually would learn its location, kick out rubber-tappers like him, and take over. Unable to obtain legal title to land, Costa Cabral and her family lived hand to mouth selling shrimp, palm fruits, and tree oils. They set up farms and were repeatedly pushed off them. So in 1991 Costa Cabral and her siblings jumped at the opportunity to buy 25 acres on the banks of Igarapé Espinhel, a subtributary of the great river.

To non-Amazonians, the property wouldn't look like much. Located in the maze of small tributaries that flow into the Amazon's estuary, it is flooded twice a day by tides. Even when the surface is exposed, it is thick with mud so gooey it rips boots from feet with alacrity. Just before Costa Cabral bought the land, it had been ravaged by the heart of palm craze of the late 1980s, when every fashionable restaurant in New York and Los Angeles featured heart of palm salad. Pirate barges hunted palms across the lower Amazon with the implacability of paid assassins.

Costa Cabral and her family set out to work the land with techniques they had learned from their father. They planted fast-growing timber trees for sawmills upriver. For the market, they put in fruit trees. With woven shrimp traps—identical to those in West Africa—they caught shrimp in cages that drifted in the creek.

Cultivated forests like Costa Cabral's are



Terecô *priest Pedro de Souza is "channeling" a menacing female spirit: A client has hired him to cast spells on her unfaithful husband. Terecô is one of the quilombos' many hybrid religions, interweaving African and Christian beliefs with native practices.*



found throughout the Amazon River Basin. Yet careful stewardship of the environment has not always worked in Quilombolas' favor. Often environmental organizations assume that all human actions inevitably degrade the forest. Two hundred miles west of Mazagão Velho, Quilombolas on the Trombetas River managed forests so beautifully that in 1979 Brazil established a 1,500-square-mile biological reserve on the east side of the river. The legislation creating the reserve prohibited "any alteration of the environment, including hunting and fishing in

Pushing quilombo residents off their land would only worsen the plight of the forest.

the area," infuriating the people whose families had been living there for a century and a half. Ten years later, a half dozen quilombos were engulfed by a new national forest of almost equal size on the west side of the river. The national forest opened itself to a gigantic bauxite mine while forbidding its long-term inhabitants to cut down trees.

"These people are the reason the forest still exists," says Leslye Ursini, an anthropologist at the Brazilian land-management agency INCRA. "Now they are being attacked by both environmentalists and bauxite miners." Given that many quilombo inhabitants helped to generate the very Amazonian landscapes conservationists seek to preserve, pushing them off their territory will only worsen the plight of the forest, says Ursini. This view is expressed over and over by policymakers and quilombo residents across Brazil.

A year after buying her property, Costa Cabral had an unpleasant surprise: Her title, like so many in Amazonia, was a mess. "We went into the INCRA office to see if the title had gone through," she says. The family discovered that "the property was officially owned by somebody else, and the title was tied up with back taxes." Because the state had a lien on the property, she would have to pay the back taxes to own it. It was like paying for the land all over again. For more than a decade she continued selling açaí, shrimp, and medicinal plants in Macapá, Amapá's capital, slowly accumulating enough cash to pay off the taxes. She obtained her ownership papers in 2002. One day Costa Cabral stumbled across a survey party on her farm, planting stakes and tying ribbons around trees. "They were saying, 'What a great açaí place—let's divide it up and sell it,'" she recalls. The buyers would then use the courts to boot out the current occupants—a common practice in rural Brazil.

"I had a fit," she says. "I said, 'I planted this



Trailed by his brother, Roney Mafra totes the head of a bull slaughtered by a relative in Soledade. The meat will feed attendees of Bumba-Meu-Boi, a festival retelling the allegory of a dead bull brought back to life.

land.'" She showed her documents to an INCRA inspector. "They looked it up and said to the surveyors, 'Wait a minute; you can't steal this land.'"

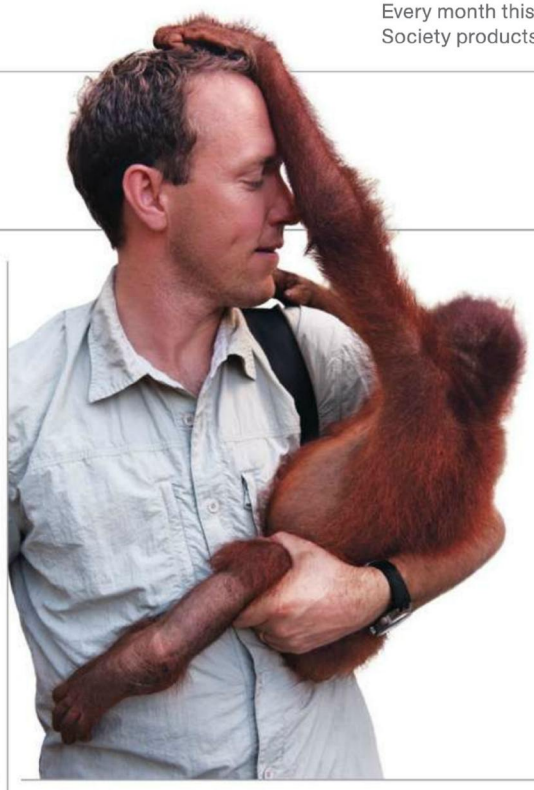
In 2009 President Lula signed Provisional Law 458, a remarkably ambitious attempt to straighten out land tenure in Amazonia—a root cause of the violence and ecological destruction of the past 40 years. It grants title to quilombos whose members already occupy the land and have less than 200 acres apiece. The law has been challenged in court on behalf of industrial and environmental groups, both of which argue vehemently that it rewards squatters for taking land illegally. But as implementation gets under way in most states, the hope is that it can bring a centuries-long struggle to a victorious close. Pulling these thousands of settlements out of the shadows will allow the state to invest in schools and clinics, something it can't legally do while their existence is contested.

We spoke to Costa Cabral soon after the law was signed. She had not heard the news. But as we told her about it, she nodded vigorously. "It's about time," she said. □

NG CONNECT

Every month this page features our staff picks of National Geographic Society products and events. For more go to *nglive.org.*

LECTURE



Mattias Klum and Johan Rockström in Seattle

Take a whirlwind tour of the planet with two dynamic guides. National Geographic Fellow, photographer, and filmmaker Mattias Klum (left) and internationally recognized scientist Johan Rockström team up for an inspiring presentation that shares ideas from their new book on global sustainability. From April 29 to May 1 in Seattle, Washington. For tickets go to *nglive.org.*

APP

PHOTO TIPS FOR NOKIA Before you snap your next picture, consult the pros using our photography app for Nokia devices. Legendary Geographic photographers discuss light, composition, palette, and more in this visual guide. Find it in the Nokia Store.

SPECIAL



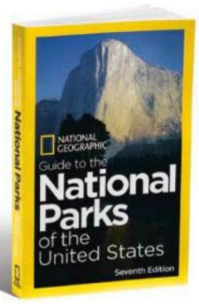
CATS AND DOGS Ever wonder what your pet is thinking behind those lovable eyes? This special newsstand edition explores the behavior and history of cats and dogs and celebrates the roles they play in our lives. Featuring delightful photographs as well as wisdom from Dog Whisperer Cesar Millan, this must-have for animal fans is available now ($11.99).

EXHIBIT

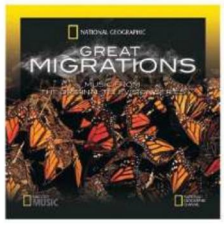
SIMPLY BEAUTIFUL This show highlights a stunning collection of photos from the National Geographic Image Collection; at the Minnesota Marine Art Museum through May 27. For more visit *www.minnesotamarineart.org.*

BOOK

AMERICA'S NATIONAL PARKS Hit the trails with the *Guide to the National Parks of the United States.* This updated edition of our best-selling guide provides itineraries, activities, and maps for all 58 national parks. Available now ($26).



Free Download of the Month



Great Migrations: Music From the Original Television Series

Anton Sanko's Emmy-winning score for *Great Migrations* takes listeners on a thrilling journey of survival. Composed to accompany the National Geographic Channel series, this tour de force captures the struggle of animals moving across the globe. Download "Monarch Butterflies," a selection from the sound track, at *natgeomusic.net/free.*

PHOTO: LARS-MAGNUS EJDEHOLM

The invention of the year is great news for your ears



Perfect Choice HD™ is easy to use, hard to see and costs far less than hearing aids… it's like reading glasses for your ears™!

New Personal Sound Amplification Product is an affordable alternative

Over the years, technology has made the way we live easier, safer and more convenient. In many cases, it's even made many products more affordable… (remember how much the first VCRs used to cost?). Unfortunately, the cost of hearing aids never seemed to come down. Now, a new alternative has been invented… it's called Perfect Choice HD™.

"Reading glasses for your ears"

Perfect Choice HD is NOT a hearing aid. Hearing aids can only be sold by an audiologist. In order to get a hearing aid, you had to go to the doctor's office for a battery of tests and numerous fitting appointments. Once they had you tested and fitted, you would have to pay as much as $5000 for the product. Now, thanks to the efforts of the doctor who leads a renowned hearing institute, there is Perfect Choice HD. It's designed to accurately amplify sounds and deliver them to your ear. Because we've developed an efficient production process, we can make a great product at an affordable price. The unit has been designed to have an easily accessible battery, but it is small and lightweight enough to hide behind your ear… only you'll know you have it on. It's comfortable and won't make you feel like you have something stuck in your ear. It provides high quality audio so sounds and conversations will be easier to hear and understand.

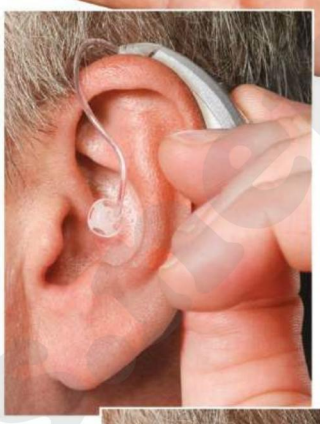
Perfect Choice HD vs Traditional Hearing Aids

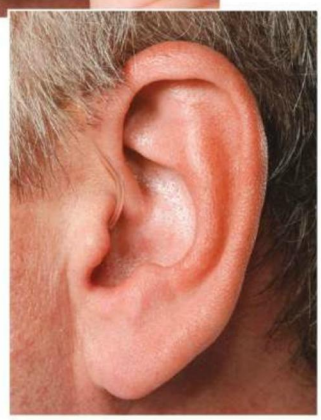
	Perfect Choice HD	Traditional Hearing Aids
Lightweight and Inconspicuous	YES	Some
Easy Toggle Switch Adjustment	YES	Few
Intelligent Setting Memory	YES	Few
Tests and Fittings Required	NO	Yes
Affordable	YES	as much as $5000
Friendly Return Policy	**YES**	**rarely**

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Cleaning Up K2

What goes up doesn't always come down, such as remnants of human expeditions to Earth's most forbidding peaks. So when an avalanche forced photographer Tommy Heinrich to abandon a K2 summit attempt, he wasted no time organizing an effort to get garbage off the Karakoram Range giant. He and other team members had noticed alarming amounts of trash: old fuel containers, car batteries, stoves, tin cans, glass bottles, and more. With the help of donkeys, camels, and a hired crew, the project relieved K2 of nearly 1,800 pounds of litter. *—Luna Shyr*

Society Grant This project was funded in part by your National Geographic Society membership.



BEHIND THE LENS

What was happening here?

TH: We were at 16,400 feet, returning from the base of K2 (at right) through a moraine of rock and ice. Two camel herders, Kudus (at left) and Umer, were carrying empty gas canisters and other garbage—90 pounds and 70 pounds each. The donkey had over 250 pounds, including tent poles, rusted chairs, and poorly burned plastic. After 14 hours of walking, the herders left some canisters near camp, which we later collected. The loads were too heavy, and everyone was very tired.

What inspired you to lead the garbage removal project?

I love nature. Seeing it pristine, pure, and clean is crucial to me. On this occasion I was terribly frustrated seeing how dirty our mountains were. I've been part of many expeditions and every time have removed garbage from the mountains. I think it's hard to justify that we could leave so much trash behind. Mostly with climbers it's because we are tired, running out of time, stuck in storms, have to carry a lot of weight, or because it's expensive to remove garbage and take it back to the cities from which we start our trips. On the day I took this image, we collected 860 pounds of trash from one place on the glacier.

LEGAL NOTICE

If you own or owned a home, building or other structure containing a Plumb-PEX plumbing system, you could get benefits from a class action settlement.

A settlement has been reached in a class action lawsuit about whether Radiant Technology, Inc. and Uponor, Inc. ("RTI" or "Defendants") sold Plumb-PEX plumbing systems with brass insert fittings and stainless steel clamps that may leak and cause damage to property. Defendants deny all of the claims in the lawsuit, but have agreed to settle the case to avoid the cost and uncertainty of a trial.

Who's included?

Those included, together called a "Class" or "Class members" include anyone who owns or owned a property containing an RTI Plumb-PEX plumbing system, containing ASTM standard F1807 brass insert fittings and stainless steel clamps installed on or after May 15, 1999. Owners of systems that have: (a) had a leak in one or more of the system's components, or (b) a water flow differential of 50% between the hot and cold lines that supply one or more fixtures could get benefits. A picture of the RTI Plumb-PEX Plumbing System components can be found at www.RTIsettlement.com.

What does the settlement provide?

RTI will reimburse Class members for property damage caused by a qualifying leak and pay reasonable costs associated with the repair or replacement of affected components. They will also pay reasonable costs to repair or replace affected components or possibly the entire system in structures that have had two or more qualifying leaks. Eligible Class members will have at least 18 months to file a claim even if that time period expires after their warranty. Persons and entities that have paid claims for qualifying leaks related to an RTI Plumb-PEX Plumbing System component are also included and may file a claim to be reimbursed.

How do you ask for benefits?

To request (a) a payment for past property damage or repairs, or (b) to have repairs performed on an eligible system, you must complete and submit a claim form. The earliest deadline to submit a claim form is **December 26, 2013**. Actual deadlines will vary by property based on when a problem occurred and whether the system's original warranty is still in place. Claim forms are available at www.RTIsettlement.com.

What are your other rights?

You have a choice to stay in the Class or not. If you submit a claim form or do nothing, you are choosing to stay in the Class. This means you will be legally bound by all orders and judgments of the Court, and you will not be able to sue or continue to sue RTI about the legal claims resolved by this settlement. If you stay in the Class you may object to the settlement. You or your own lawyer may also ask to appear and speak at the hearing, at your own cost, but you don't have to. The deadline to submit objections and requests to appear is **June 1, 2012**. If you don't want to stay in the Class, you must submit a request for exclusion by **June 1, 2012**. If you exclude yourself, you cannot get benefits from this settlement, but you will keep any rights to sue RTI for the same claims in a different lawsuit. The detailed notice explains how to do all of these things.

The court's fairness hearing.

The U.S. District Court for the District of Minnesota will hold a hearing in this case (*In Re: Uponor, Inc., F1807 Plumbing Fittings Products Liability Litig.*, MDL No 2247), on **June 26, 2012** at 11:00 a.m. to consider whether to approve: the settlement; attorneys' fees, costs, and expenses of up to $2,400,000; $7,500 in payments to the Class Representatives, John & Helen McGregor, and a payment of $5,000 per home to nine other Class Representatives. These fees, costs, expenses and payments will be paid separately by RTI and will not reduce the amount of benefits available to the Class. If approved, the settlement will release RTI from all claims listed in the Settlement Agreement.

How do you get more information?

View the detailed notice and Settlement Agreement at the website, call 1-855-248-4368, or write to Plumb-PEX Plumbing System Settlement, PO Box 869066, Plano, TX 75086-9066.

1-855-248-4368 **www.RTIsettlement.com**

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Model Citizen At London's Kensington Gardens, every Sunday morning in 1953 marked departure time for the *Empress of Britain*—in miniature. Modelmaker (and weekday bus driver) Alfred Kidd based his 93-pound steam-powered ship on the namesake Canadian ocean liner sunk by a Nazi torpedo in 1940. The vessel took Kidd four years to build, working an average of three hours a day.

"While other folks are wrapped up in scarves and overcoats against the cold winds," say notes accompanying the photograph, "Alfred Kidd, coatless, is active and happy as any schoolboy as he sets the course for his model and runs round to meet it on the other side of the Round Pond." *—Margaret G. Zackowitz*

Flashback Archive Find all the photos at **ngm.com.**

PHOTO: NATIONAL GEOGRAPHIC IMAGE COLLECTION

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